POPULAR AVIATION

Combined with Practical Mechanics; Including Aeronautics and Aviation Stories and Mechanics

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

Volume XII | JUNE, 1933 | Number 6

TABLE OF CONTENTS

Feature Articles

AN AIRY CHAT WITH THE EDITOR 346
NEW DEVELOPMENTS IN GROUND STRAFING 348
GUYNEMER, THE MAN OF MYSTERY 351
DISASTER VISITS THE AKRON 353
BARNSTORMING WITH A CAMERA 355
AN AIRPLANE GUARDS THE PAYROLL 357
A NEW GERMAN PADDLE SHIP 359
EDISON'S EARLY DREAM SHIPS 360
DREAM SHIPS BY OUR DREAMERS 361
THE LATEST BOEING LOW-WING TRANSPORT 362
L. A. A. CHAIRMAN AIRS VIEWS 365
NOTES ON THE HEINKEL TRANSPORT 367
QUESTION AND ANSWER DEPARTMENT 368
THE CASE AGAINST TRI-MOTORS 369
THE AERO SPORTSWOMEN 370
LANDING BY RADIO BEAMS 371
STANDARD FLYING STUNTS 373
HOW TO BUILD THE CORBEN JUNIOR ACE 375
HOW WING RIBS ARE TESTED 379
WHAT OUR READERS ARE BUILDING 381
HOW TO BUILD THE CURTISS "SWIFT" 383
BUILD THIS ROTOR SHIP 387
BARTER AND EXCHANGE 389

THE PICK OF THE BRIEFS

Ashes of a Russian Pilot 354
Be-Kind-to-Animals Week 354
Adjusting the Folding Wings 356
Count Zeppelin's First Dirigible Patent 356
More About the U. S. S. Macon 358
Good Morning Dreamers 361
New Two-Cycle Engine 364
Air Corps Organization Nears Completion 364
Details of Swedish Tiger-Swallow 366
Plane for Columbian Government 366
A Collection of Historic Lockheeds 372
Some Details Concerning the Douglas O-35 372
How to Shut Her Off 374
A Homemade Glider Shock Cord 378
The Norrbom Diesel 380
Lightplane Operation 381
Wing Slots and Flaps 382
Take Off and Landing Speeds 382
POPULAR AVIATION at World's Fair 388

POPULAR AVIATION, Volume 12, Number 6, June, 1933. Published monthly by Aeronautical Publications, Inc., at 608 South Dearborn Street, Chicago, U. S. A. William B. Ziff, Publisher; B. G. Davis, Editor; John B. Rathbun, Managing Editor. New York Office, 551 Fifth Avenue, New York City. Subscription $2.50 per year, single copies, 25 cents, foreign postage, $1.00 per year extra. Contributors are especially advised to retain copy of their contributions, which must be accompanied by return postage. All such material will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to revision or changes to meet the requirements of this publication. Payment for copy used will be made at our current rates. Entered as second-class matter, January 24, 1933, at the Post Office, Chicago, Ill., under the act of March 3, 1879. Additional entry, Springfield, Ohio.

New Developments

—U. S. Army Air Corps Photo

The beginning of a bombing practice attack by an attack squadron. Note the direct hit on the second plane from the left in lower line.

by

T-2003

Noted authority on modern military aviation and tactics.

THROUGH the black night all about them and the muddy ruts underfoot, the men toil on. Weary, stumbling, uncertain and confused, each man blindly keeps on the heels of the man ahead.

Someone lights a match, but drops it at the snarling command of a non-com who shoots a flashlight beam in at the would-be smoker. The weary voice of the captain reproves the sergeant for the further show of light.

Behind them, the truck train smashes along, they will soon have to give way to it. Somewhere ahead lies the hell that is the Front for this is "Tomorrow's War," and this is the enemy at move in the night.

"Hang around all day doin' nothin' but waste good daylight," complains a Replacement, "and then march all night. Now, if *I* was runnin' this Army—"

A chorus of cursing jeers from the old timers within earshot cut him off.

"Tell Mamma's Boy about the American's Attack Aviation," suggests a voice out of the darkness, "and what happened to the -th Division last week when they got caught out after sunrise."

"Wouldn't surprise me to see 'em start operatin' in force at night," mutters another. He voices prophecy.

From somewhere at the right comes the whining roar of an airplane engine, about 100 feet off the ground, the airplane spewing bright flares that hang from parachutes so large that their descent is hardly noticeable. Then one reveals the troops along the road. Avigation has been uncertain over the unlighted country, but the vicinity of the enemy's movement once surmised by the Americans, it has been a simple matter for the parachute flares to seek them out by the advance plane.

A following ship turns where the last flare is burning and tears up and down the road, dropping flare after flare. Each flare is rated at 250,000 candlepower and burns for four minutes. And in that time all hell lets loose from air and ground.

A hail of bullets comes from the roaring whirlwind, which is invisible above the glare of the floating flares, tearing down upon the groundlings. The latter take to the ditches—those that are still able—and squat down beside their upward pointed rifles, working bolt and trigger, sending up a 30 calibre barrage. The men on the trucks swing out machine guns on mounts fastened to the vehicles' bodies, —then the bombs burst, following the earlier rain of lead.

The three flights in the attack squadron loosen out and the nine ships in each flight split up into three-plane elements, each element flying a "V" formation as it tears along the road, and each flight taking care of its own length of the highway. As they approach their target, they rake it with machine-gun fire followed by bombs as they come directly over their prey.

Each pilot is able to drop only half his 20-bomb load at the first pass. The eggs weigh 25 pounds and contain four pounds of TNT. Around again and the rest of the load is dropped. Then a third time, with all four forward guns spitting fire. Each flight takes a battalion as its particular prey.

The gunners in the rear seat of each ship are also doing their bit. No need to stand up in the terrific slip-stream and fire below and to the rear—there's other work to be done. More flares to

—U. S. Army Air Corps Photo

End of the attack, one plane completely destroyed, one bursting into flames and one plane nearly consumed.

s in Ground Strafing

DIRECT attacks upon the enemy infantry by planes, known as "ground strafing," is one of the most effective offensives known to military aviation.

Flying close to the ground, the specially built attack planes deliver a hail of bullets from the machine guns followed by a shower of light bombs. In such a surprise attack, made at a terrifically high speed, the attack planes can inflict severe losses upon the infantry.

—U. S. Army Air Corps Photo

A flight of six YA-8 U. S. Army Air Corps attack planes flying low at their normal attack altitude. This picture is one of the few taken of a large group of YA-8's.

be dropped when needed and hands and feet always close to the controls, ready for any emergency.

They should be. In the second element of "B" flight, a bullet finds a pilot. The gunner takes control but it's a losing game for the pilot's body has slumped against the stick and the ship dives.

It's all over, so make the best of it and the gunner kicks the rudder around and squares away over the road. Too low for parachutes. Let 'er ride! To the confusion on the road is added that of a crashing ship among the mass of men and trucks.

Two others from that same flight have burst into flames, for the barrage from below has taken its toll. One dives alongside the road, the other pulls up and up, then the pilot and gunner jump to come down via parachute, just before their craft explodes in mid-air. Back in "C" Flight, one whole element leaves the scene and limps for home, all three planes with missing motors. Flight "A" up ahead has suffered a dead gunner and two wounded pilots.

And then, just as suddenly, the attack ends.

There is no rallying point in the darkness, but somehow the elements still in the air find their flight leader, then each flight streaks for their home airdrome, throttles pushed forward, skimming the treetops to avoid the searchlights of the enemy, through the 30 miles of enemy territory. They may still meet a hostile pursuit patrol but the chances are few. Over the front lines they go and 30 *more* miles back of the front to their home airdromes. At the returning warriors' pre-arranged signals the fields are lighted and the pilots make their landings.

The "Skipper" checks up on his squadron. Two minutes later only one ship of the prematurely departing element turns to a landing. Its crew are sure that one of the two missing ships of that trio landed safely in friendly territory at an advance observation airdrome. The other?

"Put them down as prisoners," says the Major.

"Three pilots, three gunners dead. Two each are prisoners. One pilot wounded. One ship not yet in, but probably O. K. Flight Leaders get busy on their reports," and the Skipper calls it a night. His squadron went out with 28 airplanes, plus two that were rigged out as flare-carriers.

Casualties have been heavy. For that matter, attack aviation may suffer more casualties per hour over the lines than any other branch of military aviation, although Captain George C. Kenney, former Chief Instructor of Attack Tactics at the Air Corps' Tactical School states that with proper training such should not be the case with the "hedgehoppers."

But back in enemy territory, far beyond the range of artillery, an entire regiment has been decimated and the Division Commander of these stricken ground troops rages at the delay in moving up his outfit.

"First they keep us off the road during the day. Then they go out singly at night and smash up the cross-roads. Now they come in force at night."

A growing fear is on him. Is there no answer to this attack aviation of the enemy? Has his side been wrong in their pre-war under-rating of the value of specialized airplanes and squadrons and a well developed technique for ground strafing?

* * *

We leave tomorrow and return to the present to see what we have been doing in this country with this unique branch of combat aviation and fly to a city in the South, one of the new fields constructed for the growing needs

—U. S. Army Air Corps Photo

The latest ground strafer, the YA-8 Attack plane now in use by the U. S. Army Air Corps. This terror of the air is the result of extended experiments.

of the Army Air Corps under the Five-year Program.

There is no other place like it in the country and perhaps not in the world; this field to be devoted to the activities of an Attack Wing. Named after an heroic flyer of the Southland, Barksdale Field, future home of the Third Attack Wing, lies just across the Red River from Shreveport, Louisiana. Lieutenant Eugene Hoy Barksdale, after whom the field is named, was born November 5, 1895, at Goshen Springs, Mississippi.

The field, containing 23,000 acres, is now the home of the 20th Pursuit Group, composed of the 55th and 77th Pursuit Squadrons recently removed from Mather Field, Sacramento, California, and the 79th Pursuit Squadron, to be organized there at Shreveport. This group is one-half of the Attack *Wing.*

The other is the Third Attack *Group,* now in its temporary home at Fort Crockett, Galveston, Texas, but which is slated for removal to the field in Louisiana. The Third Attack Group, commanded by Lieut. Col. Horace Hickam, is composed of the 8th, 13th and 90th Attack Squadrons and the 60th Service Squadron, and except for an attack squadron in Hawaii, is the only attack aviation unit.

Ordinarily, an Air Wing is a very temporary organization in war time. In time of peace, however, the combining of two different branches of aviation at one field into a Wing affords the opportunity of combined training not otherwise possible.

The 1st Bombardment Wing at March Field, California, composed of the 7th Bombardment and 17th Pursuit Groups, and the 2nd Bombardment Wing at Langley Field, Virginia, composed of the 2nd Bombardment and 8th Pursuit Groups, are the other two Army Air Corps Wings in the States. The 18th Composite Wing in Hawaii and the 19th Composite Wing, not completely organized, in Panama, are the only others.

Where a pursuit group is stationed with an Attack Group, it is possible for the latter organization to practice their ground-strafing missions and at the same time develop a defense against hostile pursuit formations. They can also perfect themselves in the technique of fighting off a horde of pursuit ships intent on spoiling the success of an attack raid.

—*U. S. Army Air Corps Photo*

The recently constructed buildings at Barksdale Field, an example of an ultra-modern military aviation field.

A ground target after being peppered by an attack plane's machine guns. Note the bulls-eye hits.

Attack aviation also must work with bombardment aviation to perfect a technique in combining their efforts. In a bombing raid, the attack units go ahead of their own bombers and strafe the enemy anti-aircraft with bombs and bullets. Or they can render them just as ineffective by laying thick smoke blankets over them; blotting out all sight of the high flying marauders dropping bombs on the target which the A. A. artillery is supposed to defend.

Besides the strafing of anti-aircraft and troops on the march, attack aviation is used against troops in bivouac and to destroy important communication lines. In addition, they perform the most effective mission against enemy aircraft,—catching them parked on their home airdrome and raking planes, hangars and personnel with bombs and bullets.

The 23,000 acres of Barksdale Field offer sufficient territory for such practice. The lack of practice gunnery and bombing ranges is a serious matter at some of our Air Corps fields, but such is not the case at Barksdale, where acreage for such ranges is plentiful, aside from the landing area. This landing field itself is about two miles long by one mile wide and already is growing a thick mat of Bermuda grass.

The building area is laid out in the shape of a fan. Already four barracks, with a total capacity of over 850 soldiers, have been completed and two more barrack buildings are being constructed. There are also quarters for 42 married squadron officers and 68 married non-commissioned officers with 30 more officers' and 30 more non-commissioned officers' quarters about to start building. The bachelor officers will live in an apartment house which, with the hospital, is also soon to be constructed.

The Headquarters Building is completed and in addition, several others are finished—the fire and guard house, garage, Quartermaster warehouse, Quartermaster utilities shop, post exchange, gymnasium, four hangars on the flying line, field shop, Air Corps supply warehouse, parachute and armament building, radio office, photo hut, oil warehouse, and a gas and oil storage system. The field has been drained and paved, warming-up aprons placed

(*Concluded on page* 404)

—*U. S. Army Air Corps Photo*

The flying field on the outskirts of Barksdale Field, near Shreveport, La. Ample room here for all sorts of flying maneuvers.

Guynemer—the Man of Mystery

by CARL B. OGILIVIE

Has the mystery of Guynemer's disappearance been solved, or will his fate always remain a mystery? The author presents his version of a widely discussed affair.

CAPTAIN GEORGES GUYNEMER believed he was a fighting dead man.

He was an amazingly reckless pilot, a ferocious fighter and a deadly marksman. Fifty-three German planes were officially recorded as having gone down before the withering fire of his machine guns and the inescapable fury of his invincible attacks. Guynemer laughed at Fate. He believed he was a doomed man. Seven times he was shot down in a bullet-riddled plane. The eighth time is still shrouded in the deepest of mystery.

Almost everyone believes Guynemer is dead. Will this baffling one-man mystery of the French Air Force ever be satisfactorily solved? I believe some day it will. That man I met in the south of France haunts my memory.

Guynemer became the Ace of Aces of the French Air Force. He participated in eight hundred aerial battles. The actual number of his victories more probably was three times the official record of fifty-three. He won immortal fame adhering to his credo —"Attack and kill!" Once he went into a melee, he stayed in until his adversary went down, or he was forced out of action by his crippled plane or motor.

Georges Guynemer received every honor and military medal his grateful country could bestow upon him. He was the idol of France. They called him Guynemer "The Indomitable"—"The Miraculous." At the age of twenty-two he vanished completely. No one knows the exact circumstances of his strange disappearance. Legends have been woven about his daring career.

Guynemer was a pale, slender, sickly young man, troubled by lung and stomach disorders. He was convinced that he would die of his ailments. He was a fervent patriot, fought only to die in the blood-stained skies for the glory of his country. Guynemer kept knowledge of his physical weakness from the world. He was a man of mystery.

GEORGES GUYNEMER was born near Compiegne, France. As a lad he made many models of airplanes and flew them with rubber bands. He became interested in motors and learned everything he could about them. He was an aviation enthusiast and experienced the thrill of flying occasionally with famous pilots.

Then Mars unleashed the dogs of War and gave him his opportunity.

Capt. Georges Guynemer, the outstanding ace of the French Air Forces during the World War.

With patriotic fervor, Guynemer tried to enlist in the Air Service and Infantry and was rejected as too delicate. But he was determined to fight for his country. He finally succeeded in proving to the air officers at the great French aviation school at Pau that he knew motors thoroughly and understood the principles of airplane construction. Instead of being made a mechanic, he was put in a labor battalion digging ditches, carting materials for hangars and barracks. He was in the army!

With an indomitable determination to fly, Guynemer finally got permission to try his hand at flying a three-cylinder Bleriot. In February, 1915, he won his pilot's certificate and soon became a military aviator. So well had he displayed his inherent sense of flying that he was sent to the "Cicognes" or "Storks"—the most famous pursuit squadron or *escadrille de chasse* of France.

As a corporal-pilot, Guynemer was assigned to a nose-heavy Caudron observation plane. His first victory amazed his comrades as it was a rare accomplishment for one observation plane to bring down another during those early days of the war. Later, from Georges own handwriting, I copied the following signed account of his first battle.

July 19th, 1915.—Left with Guerder (Guynemer's observer) upon being signaled that a German had been seen above Vocuvres. Reached him above Pierrefonds and fired a roll. The machine-gun jammed, and I had to free it. The German fled and landed near Laon.

At Coucy we sighted a two-seater Aviatik down at 3200 meters going toward Soissons. We followed along above it and as soon as it crossed our lines we piqued downwards until well below it. We zoomed then and took position about 50 meters underneath.

I pressed the triggers. At the first salvo the Aviatik yawed abruptly and a piece flew from it. The pilot answered with his carbine. One bullet pierced my wing. Another scratched the hand and head of Guerder, my observer. I fired another salvo and was rewarded by seeing the pilot slump down in his cockpit. The enemy observer threw his arms over his head and the Aviatik fell in a vertical dive and burst into flames, crashing down in No-Man's Land.

We landed at Carriere l'Eveque. The Germans in the trenches turn their guns on us. In trying to get out of range I ran into a haystack and shattered the propeller.

(Signed) Georges Guynemer.

For this deed, Guynemer won the Military Medal for Valor. And on December 23rd—his twenty-first birthday—he received France's highest honor. He had shot down five planes, was an Ace on the honor roll of the fighting Cigognes and was awarded the Medal of the Legion of Honor.

GUYNEMER'S battles, victories and narrow escapes from death were astonishing. He would hurl himself at a German formation of any number, and he ran up a staggering total of victories. He gloried in defying death, knowing he was a doomed man. Every bullet hole in his plane—taxi, he affectionately called it—Guynemer painted red, making conspicuous the number of times death had missed him.

Once he miraculously escaped being wounded when the duck boards beneath his rudder were riddled by bullets. Taking his feet off the rudder bar saved him. Another time he was forced to make a dead-stick landing when seven German planes swooped

down on him and riddled his plane. His Nieuport was smashed to bits behind the French lines, but Guynemer luckily escaped injury.

One morning in July, 1916, while attacking an L. V. G., a Spandau bullet tore through the cowling of Guynemer's plane and stuck between the thumb and forefinger of his right gloved hand, just as he reached for the trigger of his machine gun.

While engaged in a hot battle over the Somme, at an altitude of 10,000 feet, he downed two enemy planes and was giving chase to the third when a shell from a French battery exploded so close that it broke the left wing of Guynemer's plane and ripped part of his cowling away. The Ace went down in a nose dive. The plane crashed but again Guynemer, "The Miraculous," escaped unhurt.

Another time something went wrong with the synchronizing mechanism of Guynemer's machine gun. As he dived down on a German, Guynemer's bullets perforated his own propeller. One blade flew off, struck the motor and seriously damaged it. But Guynemer got his German and as his enemy dropped to earth, Guynemer volplaned down to land at Chipilly without accident.

Once he was forced down with two German bullets in his left arm. Faint from shock and loss of blood, Guynemer permitted his plane to lose altitude. An exploding anti-aircraft shell pitted his jaw with splinters of shell. Guynemer, then an adjutant-pilot, was sent to a hospital in Paris to recover.

It was then that I met this great French Ace.

TO LOOK at the oval pale face, the deep-set haunting eyes, sharp nose and slender body, one was impressed that the ace of aces was hardly physically strong enough to fly a plane on eight to ten patrols a day as was his custom, to say nothing of withstanding the rigors of aerial battles.

I said encouragingly to the great ace: "If France wishes to give you any more decorations she will have to make new medals for you. You have received every medal she can bestow upon you."

He coughed and said with a faint smile and intense sincerity: "I fight to live and live to die fighting. Can you understand that, *Monsieur*?"

I looked at the folded bits of gauze he expectorated into and nodded my understanding. I had learned the carefully guarded secret of the mystery man.

Flames came into his snapping dark eyes. Guynemer said: "I will never stop fighting as long as I am physically able to fly. Neither will I surrender as long as I have a bullet left to fire!"

And I knew Guynemer meant what he said.

As an act of distinction for their leading ace, the Cigognes gave Guynemer, when he returned from the hospital, the first Spad plane to come from the factory.

Capt. Georges Guynemer, third from the left, with a group of French Air officers at Compiegne, Oise, France, March 1, 1917. Note the wan and emaciated appearance of this great ace, accentuated by comparison with the other officers.

Guynemer named his Spad "Old Charley," and painted the name on the sides of the fuselage. With this Spad and a pair of twin Vickers machine guns, he won 19 of his 53 accredited victories. I saw Old Charley later on exhibition in the palace of the Louvre in Paris.

The mystery man was suspected of having a charmed life. No one knew how ill he was. Bullets had drilled the fuselage all around him, slashed his wind deflector away. At other times bullets had just come short of killing him by landing in his flying suit, the seat he sat upon, the joystick was splintered by a bullet, another bullet shattered his tachometer and lodged half way out—in a direct line with his heart. Such were his narrow escapes.

To Guynemer's amazing recklessness and his marvelous flying skill must be added his remarkable shooting ability. He possessed a love for firearms that bespoke the born marksman. He was a deadly accurate shot. On two occasions he shot down an enemy plane with a single bullet. May 25, 1917, he stunned the German Air Force and thrilled the Allies by shooting down four enemy planes in a single day. This was a record at that time.

GUYNEMER received another citation for his four-in-one-day victory, which I copied and translated from official French War Department records. It reads as follows:

"Officer of the elite. Fighting pilot as skillful as he is audacious. Has rendered striking services to his country not only by the number of his victories but by the daily example of his sustained ardor. In his never-failing mastery of his conflicts, he, unmindful of danger, has become for the enemy through his sureness of methods and maneuvering, the adversary feared above all others. He accomplished on May 25th, 1917, the most brilliant exploit in bringing down in a single minute two enemy aeroplanes and in addition to them on the same day two other victories. By these exploits he has contributed to exalt the courage and enthusiasm of the troops in the trenches who witnessed his triumphs. 45 aeroplanes shot down; 20 citations; twice wounded."

What a fighter he must have been—two victories within the brief flash of a single minute!

Guynemer's interest in arms led him to make many experiments with guns of various calibers. His "mystery ship" was an amazing daring experiment. The Spad was so constructed that it fired through the propeller shaft. The gun was a light one-pound cannon. This 37 millimeter gun was capable of firing projectiles measuring an inch and a half in diameter at the surprising rate of 120 per minute. Guynemer was urged to quit fighting, to devote his time to aeronautical engineering problems. He flatiy refused.

On September 3, 1917, Guynemer became captain and commander of the Cicognes Escadrille, Spad 3. France's most famous Ace now led her most famous fighting squadron. Eight days later Guynemer was to go down for the eighth time, to become the hero of legends and the details of his disappearance an unsolved mystery.

On the fatal 11th Guynemer discovered his plane was not functioning properly. He borrowed another pilot's plane and took off to give battle to the

(*Concluded on page* 398)

Disaster Visits the Akron

by JOHN B. RATHBUN

The dirigible "U. S. S. Akron," the pride of the U. S. Navy, is driven down into the sea with a loss of 73 lives. Just one more example of the fallacy of the dirigible principle often expressed in the columns of POPULAR AVIATION. Are these tragedies to continue?

ONCE more, tragedy has been written into the history of the rigid airship—tragedy so stupendous that all of the many preceding dirigible disasters pale into insignificance when compared to it.

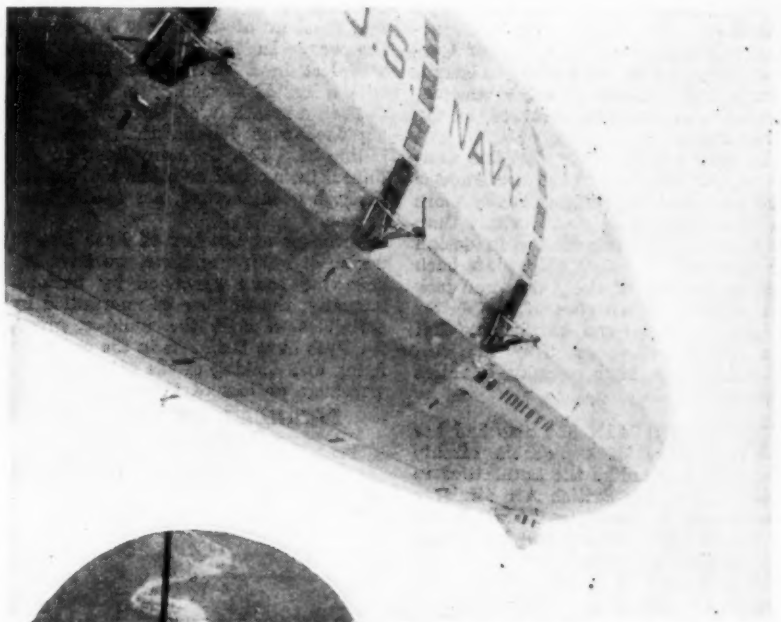
Consistently, the desire to build the "world's largest dirigible" is accountable for the increasing loss of life recorded in dirigible history.

Seventy-three valuable lives were sacrificed when the U. S. S. Akron plunged into the ocean. This one disaster accounts for nearly 25 per cent of all dirigible fatalities on record since the dirigible came into prominence. This does not, however, include the loss of life during the World War when the German dirigibles were shot down in active war missions.

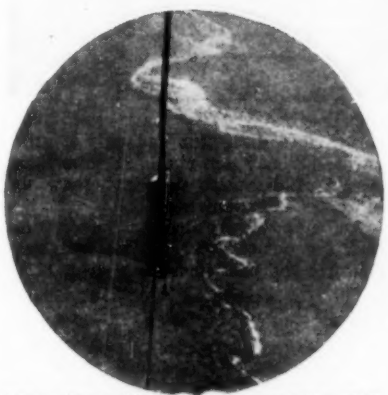
Then, what is of immediate practical interest to the overburdened taxpayers of the United States, more than $5,000,000 worth of airship now reposes at the bottom of the Atlantic. In view of this great loss of life and money, it hardly seems logical to continue such experiments, particularly when the ultimate utility of the dirigible is in doubt even though it could be perfected in a mechanical sense.

First of all, this accident teaches, that improvements in the equipment and accessories alone cannot correct a principle that is basically wrong. Since the *U. S. S. Akron* represented the latest and most scientific developments in airship design, it was conclusively proved that the lighter-than-air craft type is utterly unfit to combat adverse weather conditions.

A further check upon the above statement is the wreck of the *Blimp J-3* which went on an attempt to rescue the crew of the *Akron* with a further loss of two lives and the loss of the blimp itself.



The U. S. S. Akron, from the photograph printed in our September, 1932, issue which predicted this lamentable tragedy.



Among the accidents to the personnel is that shown in the circle. Here, one of the landing crew clung perilously to the line and was saved. His companion was dashed to death.

MAJOR DIRIGIBLE ACCIDENTS

Date	Name	Place	Cause	Fatalities
July 12, 1912	The Akron	Atlantic City	Exploded	5
Sept. 13, 1913	Zeppelin L-1	Heliogoland	Storm	15
Oct. 17, 1913	Zeppelin L-2	Johannisthal, Germany	Exploded	28
July 15, 1919	British NS-11	North Sea	Lightning	12
July 21, 1919	Wingfoot Express	Chicago	Burned	10
Jan. 12, 1921	British R-34	Howden, England	Storm	None
Aug. 25, 1921	British ZR-2	Hull, England	Structural fault	44
Feb. 21, 1922	Italian Roma	Hampton Rds., Va	Rudder cable	34
Dec. 31, 1923	French Dixmude	Sicilian Coast	Not known	52
Sept. 3, 1925	Shenandoah	Caldwell, Ohio	Line squall	14
May 17, 1928	The Italia	Arctic Regions	Incompetency	9
Oct. 5, 1930	British R-101	Beauvais, France	???	46
April 4, 1933	The Akron	Barnegat, N. J	Storm	73
April 4, 1933	Blimp J-3	Beach Haven, N. J	Storm	2
April 4, 1933	French E-9	St. Nazair, France	Engine trouble	None

Storms that are easily evaded by airplanes, because of their higher speeds and better maneuvering qualities are very frequently fatal to the slow moving dirigible with its length and great expanse of surface. The boiling air turbulence in the vicinity of a thunderstorm or line-squall imposes on a dirigible structure stresses that are almost impossible to resist within the practical limits of weight.

Both the United States and Great Britain have been notably unfortunate in the construction and navigation of dirigibles. We have had six major dirigible accidents in the United States which have taken the lives of 138 men. When we consider the few airships that have been placed in commission, this is an intolerably great number of fatalities. Each accident has averaged 23 deaths. We do not include, in this number, fatal accidents occurring in the operation of the ship where the ship itself escaped wreckage.

Dirigible catastrophes in the United States began in 1912 when the first *Akron* exploded at Atlantic City and killed 5 men. Then there was a lapse until after the World War when the Goodyear Blimp *Wingfoot Express* burned over the Loop District in Chi-

cago, sending ten men to their deaths. But these accidents were trivial compared with the *Roma* disaster at Hampton Roads, Va., an accident in which 34 men died when a broken rudder cable sent the ship into a high-tension electric line. Following this catastrophe came the wrecking of the *Shenandoah* in a line squall at Caldwell, Ohio, where 14 were killed.

Of all the dirigibles flown in the United States, the *U. S. S. Los Angeles* has alone indicated any degree of success. Like the *Graf Zeppelin* of Germany, the *Los Angeles* seems to bear a charmed life, escaping all of the catastrophes that have occurred to the other ships.

In view of the other dirigible accidents, this immunity of the *Los Angeles* and the *Graf Zeppelin* is really more to be attributed to good fortune than to any inherent superiority in design or construction. Both ships date back before the time of the *Akron* and lack the modern refinements of the latter ship, so that we can hardly say that the *Los Angeles* and *Graf* are still afloat because of airworthy qualities alone.

GREAT BRITAIN has also had her full share of deplorable airship disasters, but unlike the authorities in this country, the British Air Ministry has learned its lesson, washed its hands of the dirigible fallacy and has ended its dirigible program.

The British dirigible NS-11 was struck by lightning while over the North Sea in 1919, and suffered a loss of 12 men. Next came the R-34, the first dirigible to fly the Atlantic, which was broken up by a storm at Howden, England, fortunately without any loss of life.

Then, just seven months later, came a greater blow to the British dirigible service, the destruction of the ZR-2 at Hull, England, attended by a loss of 44 men. Finally, came the wreck of the R-101 at Beauvais, France, with a record of 46 dead. This latter accident so impressed the British with the futility of lighter-than-air craft that they scrapped their entire dirigible fleet with the exception of a few scouting type blimps.

Germany has not come out of the dirigible idea unscathed by any means. All four of the first Zeppelins constructed by Count Zeppelin were lost, and numbers of them were lost during the war. In 1913, the Zeppelin L-1 was lost in a storm over Heligoland with a loss of 15 men.

Then a month later, the Zeppelin L-2 exploded over Johannisthal, Germany, killing 28. Yes, Germany has had her difficulties as well as other nations but through good fortune, not to the same degree.

In order of number of lives lost in major dirigible accidents, we have the following score arranged by nations. Actually, the number of men killed by dirigibles exceeds the number given, for lives have been lost in the ordinary flying and docking of the ships without wreckage or loss of the ship.

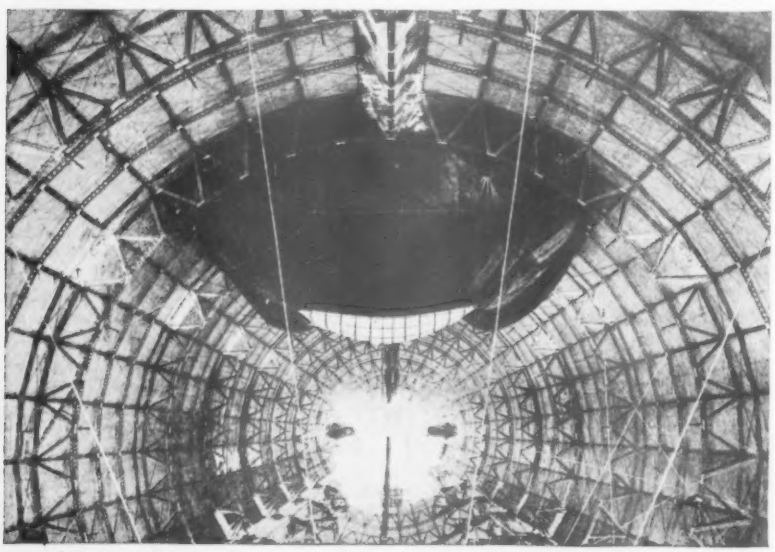
DIRIGIBLE WRECKS AND FATALITIES

	Dead	Wrecks
United States	138	6
Great Britain	102	4
France	52	2
Germany	43	6
Italy	9	1
Total	344	19

France and Italy have not built many rigid dirigibles and only a comparatively few non-rigids so that their record of disasters does not show up in terms of numbers.

And now, neglecting the human side of the equation for the time and considering the matter from a cold, hard

(*Continued on page* 396)



The complicated interior structural members of a modern dirigible are highly expensive and difficult to stress analyze accurately because of the many unknown factors.

Ashes of a Russian Pilot

by A. ALEXIS

Soyusphoto

Engine as a Funeral Urn.

OVER in Russia, they have adopted a unique method of erecting memorials to their deceased pilots. In short, the ashes of the cremated pilot are placed in an airplane engine cylinder instead of being placed in an urn. The cylinder bears a tablet with the photo of the pilot and a short biography.

Be-Kind-to-Animals Week!

GREAT BRITAIN has been called upon to deal with a new type of nuisance—the pilot who gets his amusement by swooping down and frightening animals.

So serious has the problem become in certain parts of the British Empire, especially in Africa, that the British Society for the Preservation of the Fauna of the Empire, led by its chairman, the Earl of Onslow, has launched a drive to put a stop to it—once and for all.

Speaking recently in London, Lord Onslow said: "There is a predatory species of animal in this country—the '*Sus viarum*'—and he has transferred himself to East Africa. Like many other animals he has taken to aerial ways and has become a great nuisance to the various herds of animals there, by purposely swooping down upon them and stampeding them, thus doing a lot of harm by separating the calves from the cows, when they are liable to die or get destroyed.

"The governments of East Africa have passed a law prohibiting these people from descending to a lower height than 1,500 feet."

This law also prohibits, under penalty, any approach of game in a motor or airplane within a distance of 500 yards, for the purpose of hunting, killing, capturing or unduly disturbing such animals.

Because of the ever increasing number of big game hunters flocking into Africa, this is a wise measure, and it should be rigidly enforced.

Barnstorming with a Camera

by RALPH N. MILLER

How a pilot and a photographer made barnstorming pay—not by aerobatics or stunt flying exhibitions but by taking aerial photographs of industrial plants and other commercial properties in small towns.

BITTEN the dust? Not a bit! Rather, barnstorming is reviving under a new guise. And one fresh phase—"picture barnstorming"—ushers the grand old game into the romantic realm of art.

Most young flyers hanker to cover the country by air. They can make a better living with aerial photography than in any other branch of commercial flying. "Picture barnstorming" may not be new. But it is as bright and shiny as a new quarter in most states. Boiled down, it consists of placing aerial photography on a low cost, volume basis.

Two or more fellows equip themselves with a light aerial camera. They also require an economical airplane and a car. True, that's a lusty "also", but what money-making scheme doesn't seem to call for outlay?

I'll relate the modus procedure of picture barnstorming, as developed last winter (really, it's a summer and fall racket) by Don Diegel, veteran Colorado pilot and myself through several southern and mid-western states. No doubt any number of other airmen have worked out the same details long before, but we had to learn the tricks ourselves.

We left Colorado Springs last November in a light 2-seater cabin monoplane. Cached behind the seat was a light Fohlmer-Swing aerial camera—a bit ornamental, considering our slight knowledge of sky-shooting. We had high hopes of selling a few planes or, failing in that, at least of keeping alive by use of the camera.

Our ship's 100 mile cruising range made it a "touch-and-go" between airports to Tulsa. Airplane sales promptly proved a dud. Within a week we were learning a new profession. And we found it simple to obtain good pictures with our fixed-focus camera, once we had discovered the proper type of negatives to use, and also providing that we shot on clear sunny days. Tough enough, fair weather is remarkably scarce in the winter. One nice day a week was our average. Incidentally, for the benefit of the technically interested, we used 4x5 hypersensitive panchromatic dry plates.

As our ship averaged 20 miles to a gallon of gasoline, the low cost of mile-piling led us to spread our activities. We first flew a 100 mile circle over ten towns in Eastern Oklahoma, landing several times to reload the camera magazine. Hungry eyes searched each town for institutions, factories, large estates and new buildings. All were duly shot, together with several photos of the town taken from different angles. No marauding sky bomber, looking for an enemy ammunition dump, could cover the ground more zealously.

A wealth of detail can be had from the upper altitudes provided that the proper equipment is used.

RETURNING to Tulsa at the end of the day, we hired a photographer to develop plates and make enlargements of 11 x 14 inches or larger. And as Tip Number One, the bigger the enlargement, the better the sales prospects. Later, we bought our own enlarging equipment, improvised dark rooms in hotel closets and quickly learned to make good prints.

A friend drove our car to Tulsa. We found it indispensable. Loaded with photographs, we made the rounds of every object we had shot. Three-fourths of the institutions, factories, etc., seemed glad to buy the prints and negatives of their individual grounds at an average price of $10. Many managers intimated that they had wanted aerial shots, but were reluctant to pay $75 to $100 for the work as charged by established operators located 100 or more miles away.

It paid to pare prices. We were dependent on quick cash sales and on volume to swell the profits. We couldn't file our prints, as does a local photographer and await a commensurate sum. Our success lay in covering a territory fast, collecting on the spot and then moving on to more green pastures. Only a tempting price would crack the check-books.

Yes, and we were making money at rates a fraction of the accepted scale. Our plates cost a dime each. Allowing for poor pictures and breakage, the net price ran a few cents higher. We found good photographers who would develop plates at four bits a dozen, and make enlargements at 15 cents a crack. Gasoline for a 100 mile hop ran a little over a dollar. To this was added the overhead of hangar rent, mechanical work and the sundry expenses, which make even a flivver plane fairly expensive.

Twenty-five likely pictures would average a "take" of more than $150. That left ample profit.

Of course, the plan did not work out as smoothly at first as it now flows off the typewriter. Owing to poor light, the first two trips flopped. Not to forget the grief of a burned out main bearing and three solid weeks of overcast skies. With due allowances, however, our "picture barnstorming" opened auspiciously. A few meals were postponed, but none were missed. The limiting factor was a lack of shooting weather.

We ranged briefly in Northern Texas and then foraged north through Kansas and Missouri. Business was always good, whenever we could operate. Once a week the sun would steal forth and our Flyabout would earn its keep. Now and then snow would ground us for a longer spell. Snow wrecks an air picture, producing a drab flat print entirely devoid of sales value.

NOW, a few hints as to shooting an air shot. The proper altitude from which to cover a given territory must be learned from experience. To corral

a small estate, often we would crack down from 100 feet. We had a big winged, slow landing plane.

Consequently, by my throttling the motor and stalling the ship, Don could obtain clear sharp pictures minus all movement, while allowing enough exposure to obtain proper tone and contrast. He would shoot through a side window, over the front strut, usually at a 45 degree angle downward.

It would be foolish to half-stall many ships above the tree tops, but it is not risky in a plane with a light wing loading, ample stall control and a properly feeding motor. It is essential to idle the motor, else the vibration will blur the photo.

There were plenty of early mistakes, among others being double exposure. Once a cemetery appeared superimposed on the picture of an airport. The owner declared it about justified his conception of the field.

The necessity of getting around and peddling the pictures at first appeared to be the only drudgery entailed. It was fun to maneuver over colleges, factories and parks of strange cities and later watch the magic of dark-room development draw the images out of the sensitized sheets. It soon became a source of pride to spread the enlargements on the desks of immediately interested buyers. We were selling something that was self-produced. Confidence grew with each sale until an occasional disappointment was a minor back-fire.

The sales chatter varied. To the factory executive we paraded the obvious fact that our pictures enabled him to visualize his entire plant and study prospective changes in addition to their practical usages in magazine advertising, house organ and calendar illustrations.

Colleges were sure-fire as a rule. Publicity directors snapped up the novel catalogue illustrations and art work for school annuals. Newspapers were a good bet. Large papers would con tract for prints of twenty or thirty surrounding small towns, all of which could be shot in a day.

Printed weekly in Sunday roto-gravures, the pictures popularized the paper among home-town subscribers. The big sheets were also open for good shots of colleges and large engineering projects. While popping the towns, we would flutter a shutter at every likely customer in the precincts, later liquidating the pictures from town to town by car.

From the air it was easy to pick the "cashable" prospects. Among miscellaneous matter were real estate developments, cemetery developments, new downtown buildings, lakes, dairy farms, cattle ranches, hospitals, tourist camps and large resorts. The possibilities seemed endless.

LOCAL newspapers and chambers of commerce were ready markets for town pictures. When the weather

(*Concluded on page* 398)

Adjusting the Folding Wings

Folding wings have their drawbacks as well as advantages, and here is one of the disadvantages—reassembling.

IN THE early days of the automobile, it took two or three men to put up the top. Now it rather looks as if we had reached the same point in airplane design where it takes two men to fold and unfold the folding wings of the Breda. But, perhaps this is not so bad at a public port.

However, the folding wing is likely to be the wing of the future for privately owned airplanes. It conserves hangar space, reduces hangar rental and makes it possible to tow the ship along the public highway. Let's hope in the future that there will be less work in assembly.

Count Zeppelin's First Dirigible Patent

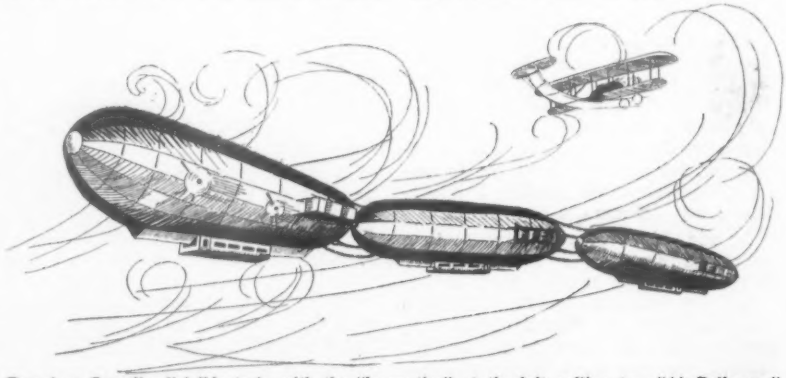
IT is interesting to note that Count Zeppelin's first dirigible patent was on an airship train which showed an airship "locomotive" pulling a train of airship-passenger-cars. The latter were called the "Pullman cars of the air" by the Count.

Determined to go ahead with this idea, he resolved to build a small model of the locomotive and then build the cars later. He betook himself to the shop of a model-maker who is reported as saying:

"Das wurde ich nicht thun, Herr Graf, das kostet Sie einen Haufen Geld!" Which means, "I wouldn't do it Sir, this will cost you a lot of money." But what did the Count care? He soon after raised about one million dollars and built a full size air-locomotive, but in the excitement of success he forgot to experiment with the cars. Perhaps the airship cars will come in the future, who knows?

But while the idea may seem fantastic yet it would have its points of merit if the proper controls could be worked out. The head resistance of a dirigible train would be much less than the resistance of a large dirigible, and the various trailers could be dropped off at stations along the way.

The great problem would be the stabilization of a series of bags of this sort so that they would normally maintain the same altitude without having a full control crew on each link of the train. But this would necessarily be fair weather flying at best.



Here is a Zeppelin dirigible train with the "locomotive" at the left pulling two "Air-Pullmans." However, the Count never got beyond the locomotive stage, which was enough of a problem within itself for one lifetime.

An Airplane Guards the Payroll

by LEONARD RAUSCH, JR.

Just another job for the airplane is the protection of large sums of money being transported along the public highways. Uncle Sam uses planes for this purpose at Wright Field and perhaps the idea could be used by large corporations.

FOR years, together with millions of other Americans, I had grown to accept with a certain definite sense of shame the knowledge that as a Nation we were rather helpless in the hands of organized crime.

But on the day that Al Capone was ushered into his quiet little apartment in Atlanta under the rigorous terms of his eleven year lease with an uncompromising landlord, I had an interview that changed this gloomy picture in a most significant way.

It was held in the headquarters office of Wright Field, U. S. Air Corps, Dayton, Ohio, and across the trim expanse of a plain oak desk sat facing me, Major Robert Goolrick, Commanding Officer.

I wanted to get the story of the unusual system of defense employed at Wright Field to guard the payroll en route from the bank to the hands of thousands of government employees stationed there.

But a high barricade of secrecy had been erected about this very public procedure (probably as effective as the Chinese Wall is today) to prevent, presumably, the temptation any publicity about it might offer. Believing that common knowledge of an adequate defense is one of the strongest factors in discouraging an attack, I decided to appeal to the Commanding Officer.

Major Goolrick, I found, was not only willing but rather enthusiastic to have these protective measures published. He felt that just as the World War gave a perfect demonstration of our potential strength to enemies without, so this account can teach much to the enemies within.

The Paymaster, Captain Louis H. Price, decided long ago that the best way to have effective well planned protection was to make the time of exposure as short as possible. So he cut out entirely, the counting of the payroll money at the field. This operation is now conducted a day ahead in the security of the bank's private vault. There is little reason why other large and private enterprises could not take this sensible precaution also.

Now, we come to the all important task of transporting the payroll from the bank to the paymaster's window. The filled envelopes have already been placed in steel drawers, locked in a strong metal frame before leaving the bank. The real task of protecting it is under the direction of Chief Paul E. Rehse, a Federal Police Officer.

In the dawn of payday morning, before the regular business day begins, a coterie of government trucks and a speedy high-powered passenger car discharge the heavily armed force of guards at the entrance of the bank. They assume their predetermined positions and an aircraft machine gun, mounted on one of the trucks, is given a clear sweep in all directions. Then, when a signal is given that the coast is clear, the locked payroll box is brought out of the bank.

But these are not all of the precautions taken in handling the money. There is just one more protective unit that is most essential to the security of the payroll.

Overhead, the roar of a low flying plane breaks the stillness. This is a regular U. S. fighting ship equipped with standard aircraft machine guns. It is ready for action the minute that the cash leaves the bank and keeps a close watch during the entire trip to the field.

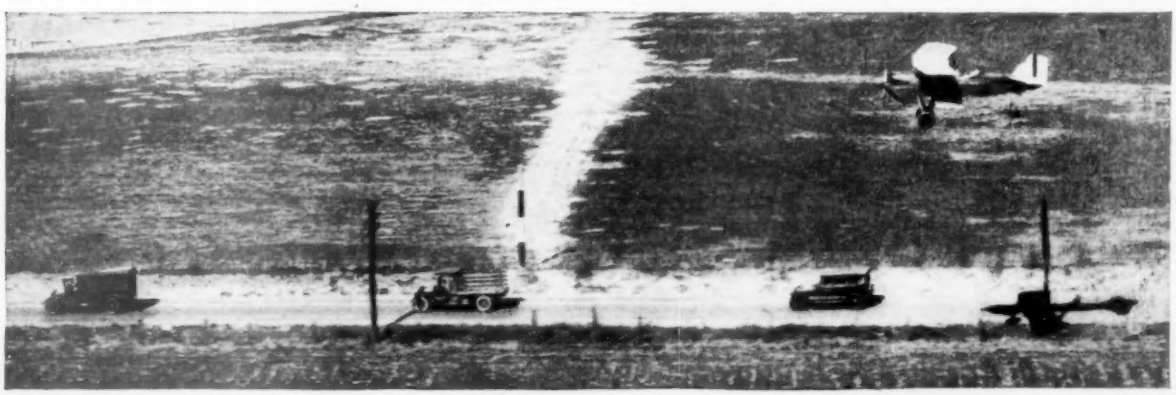
Should a gang by any possible chance, get their hands on the money chest during the few steps from the bank to the truck, they would face not only the withering blast of the machine gun, the automatic and shot-gun fire from strategic posts at street level, but in addition would be open to a veritable fiery death from the army gunner in the swooping plane aloft. There would be slim chance of a get-away even if they tried it with their speed-car. The plane could mow them down at will.

The steel-clad money vault is quickly chained and locked to the bed of the payroll truck and now the procession is ready to move. Overhead the plane dives and zooms impatiently.

First, the payroll truck gets under way. Across the top of its cab is a broad diagonal of yellow on a black ground, an insignia having the greatest possible visibility from the air. This is the car the airplane keeps constantly in sight. Following it comes the machine gun truck, effectively manned with experienced gunners. Finally, the big powerful passenger car brings up the rear. This machine is primarily for pursuit purposes.

In this order, they pass quickly through the city, running through traffic lights under special police privileges. Their route has been carefully charted to be within easy reach of the greatest number of private telephones so an alarm could be quickly spread.

As soon as the armed caravan reaches the country road, it assumes a peculiar formation. The payroll truck, which is purposely geared to the slowest speed of all the cars, keeps its position in front but as far to the right of the road as possible. The machine gun truck, following, keeps as far to the left as it can, thereby preventing any overtaking cars from passing the group. The big speed-car, bearing the guards, holds the center of the road in the rear, swinging left or right to block



Here they go, the payroll truck and its escort. From left to right we have: First, the payroll truck; second, the machine-gun truck; third, the high speed automobile, and fourth, the fighting type army plane that keeps all of the units under close observation.

any car behind that tries to go around. No one is allowed to get past, no matter how loud or how long they sound their horns. The purpose of this formation is obvious, as by no means must there be any separation of the three cars such as might happen if someone pulled along beside them. The slow speed gearing on the payroll truck is to prevent it being speeded away from pursuit cars if captured by bandits.

Meanwhile, the cruising plane swings back and forth directly overhead and somewhat in front. At no time is this part of the convoy more than a few seconds away from a position where it can train its guns on the scene of any possible action. Nor need the plane pilot depend solely upon his commanding position of observation to guess what is happening below. The driver of the payroll truck, or those guards riding with him, have only to jerk a lever within easy reach in the event of a hold-up. This will fire a red aircraft flare visible from the air for miles.

Picture for yourself the machine gun on the second truck going into action at the rate of about 400 shots a minute. See the quick spurt of the eighty-mile-an-hour passenger car filled with guards firing automatics and shotgun slugs. Hear the roar of the diving plane, broken by the sharp clatter of short bursts from the ship's gunner. Ground-strafing is nothing new for him. What price banditry now?

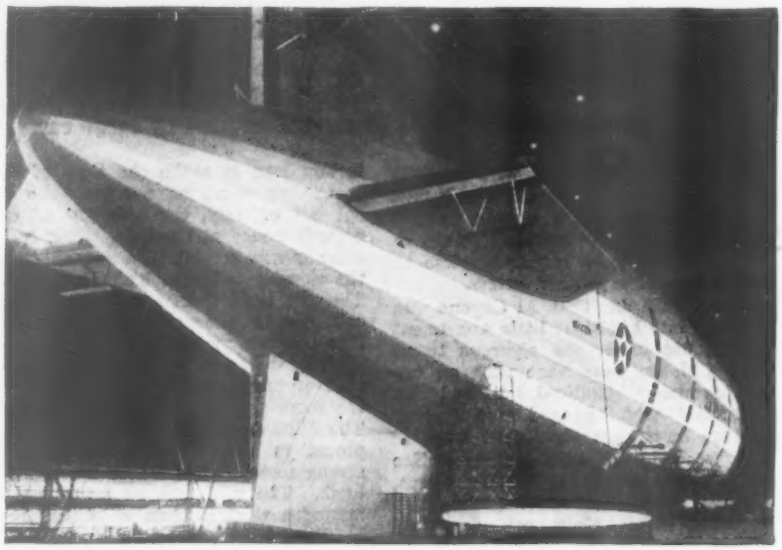
When the payroll train reaches the Field it enters a strongly guarded area containing the administration buildings, surrounded by an eight foot steel mesh fence, barb stranded at the top and with only two entrances. The regular gate-keepers are armed as soon as the payroll truck enters, and take extra precautions from that time until employees are paid off. The time of pay-off is scheduled as soon after the payroll arrives as is possible.

Signals are within easy reach to give the alarm, and if such an emergency arises one of the first things done is to close and block the entrances so no one can get out until the trouble is cleared up.

Such, briefly, are the thorough preparations for a fitting reception of any ambitious gang of payroll "heisters" that might have designs on this little shipment. You can't blame Major Goolrick for being proud rather than apologetic about it all. In fact I'd feel rather proud of the men who go to make up this reception committee.

They are all perfect gentlemen, though strangely uncommunicative. Orders are to speak to no one while on duty. Misled by a friendly look, you might stop and ask one for a light while strolling casually by the bank some morning. What you'll get is a stiff poke in the ribs with an automatic and an unmistakable gesture to move on and keep moving. That's just their way of being polite.

More About the U. S. S. Macon



The new Navy dirigible in her dock before launching.

THAT styles change rapidly in the realm of airships is shown in construction of the huge U. S. S. Macon in the Goodyear-Zeppelin Corp.'s mammoth dock, Akron, Ohio.

Although the sister ship, U. S. S. Akron, launched in September, 1931, was the very latest in air leviathan design, the Macon appears in the skies with scores of ingenious changes aiming at greater speeds and other increases in efficiency. The changes result from experience in operating the Akron.

The two ships are alike in length, height, diameter, shape, gas volume, power plants and in many other respects, but the Macon is approximately 8,000 pounds lighter than the Akron. By making various weight cuts, there is now more net lift for fuel, armament or personnel. Improved propellers and lowered resistance accounts for the greater speed attained.

Exterior alterations include equipment of outriggers, supporting the propeller shafts, with cowling to reduce resistance. This is comparable in principle to the "pants" about an airplane's landing gear. A series of ventilator hoods appeared along the Akron's top center line, but on the Macon, these are louvre-like openings which aviators will scarcely notice. The Macon's radiators are faired into lines of the hull to eliminate resistance and when closed, resemble small lumps on the ship's side. The Akron's radiators were mounted on propeller outriggers.

A new trapeze arrangement for recovering scout airplanes in flight is an improvement over the one first installed on the Akron, and the engineers have made numerous other improvements in the water-ballast recovery system, and in the method of converting water vapor from exhaust gases into water for equilibrium.

Alterations also extend to the radio system. Equipment embraces a trailing wire type of antenna so arranged as to be reeled in with use of electrical winches, and in addition, a short fixed-wire receiving antenna.

Since gelatin-latex gas cells have proved superior to rubberized fabric, the former was used exclusively on the Macon, while the Akron's cells were half gelatin and half rubberized fabric.

The Macon has a dial telephone system, lighter than the manual system of the Akron. Instead of the seven four-bunk rooms installed on the Akron, the Macon's crew quarters consist of one room with eight bunks for chief petty officers and a room with 20 bunks for lower ratings.

The Macon's electrical generating system carries further alterations. The air conditioning system has been simplified and engineers even extended changes to the galley by combining the coffee urn and water heater with the stove. A minimum weight of electrical equipment was obtained through the use of aluminum or aluminum alloy.

The ship's propellers are over sixteen feet in diameter and of two-bladed tractor type. Four appear on each side, with pitch of succeeding propellers increased as they approach the stern. Forward propellers (on each side) rotate in outboard direction. The next set aft is inboard, the third set aft outboard and the after set inboard. Design experts declare the increase in pitch on propellers as they approach stern and alternate outboard and inboard rotation will bring maximum efficiency to the multiple tandem setup. Propellers are driven by their engines through sixteen-foot transverse shafts mounted on outriggers outside the hull.

A New German Paddle Ship

by HANS KUTSCHBACH
Berlin Correspondent of POPULAR AVIATION

Still more progress in "side-wheel paddle ships" is reported in Germany where the paddle idea is developing rapidly. This type is attracting more attention than the helicopter or the Autogiro principle.

GERMANY is now in the throes of a rotary wing paddle-wheel aircraft orgy. Two different machines of the "side-wheeler" type are now under construction in Germany and several others are pending.

The latest type, called the "Air-Paddler," is the invention of Vincent Wisniewski, a Berlin architect and is the most remarkable of anything promoted along this line to date. It is a weird looking contrivance that appears more like a page out of an adventure story than an actual operative device.

This idea of Wisniewski is not a recent invention for he started experiments along this line 'way back in 1900, ornithopters in the most part which were built in imitation of bird flight. It is said that some of these highly expensive models had spans as great as 40 feet and that he obtained some astonishing results. From the beginning, this inventor was a disciple of Otto Lilienthal and he has embraced several of Lilienthal's principles into this latest ship.

He primarily became interested in wing flappers through Lilienthal's statement that wing flapping saves 80 per cent of the power needed for flight. This was based upon observations made on storks which spread the feathers of their wings when sweeping them upward and then close the feathers on the downward stroke, thus obtaining lift and compression on the latter stroke.

As will be seen from the drawing, power is applied to two double cranks on either side of the body, and the paddles extend from the ends of the cranks. The paddles are so geared to the shaft that they always remain in a horizontal position during flight. During horizontal flight, the cranks turn at 30 r.p.m. which, with the surfaces now in use, is calculated to give a lift of 22,000 pounds. The estimated forward speed is 300 m.p.h. while the ship will carry a payload of approximately 5,500 pounds. The total weight is 21,000 pounds.

Now, the paddles or wings are based upon the design of a bird's wing, that is, they are covered with small valves in imitation of the wing feathers of the stork. When the wing is moving down, the valves are closed so as to get the necessary compression for lift. When the wings move upwardly, the valves open to let the air through and thus reduce the air resistance during this useless stroke.

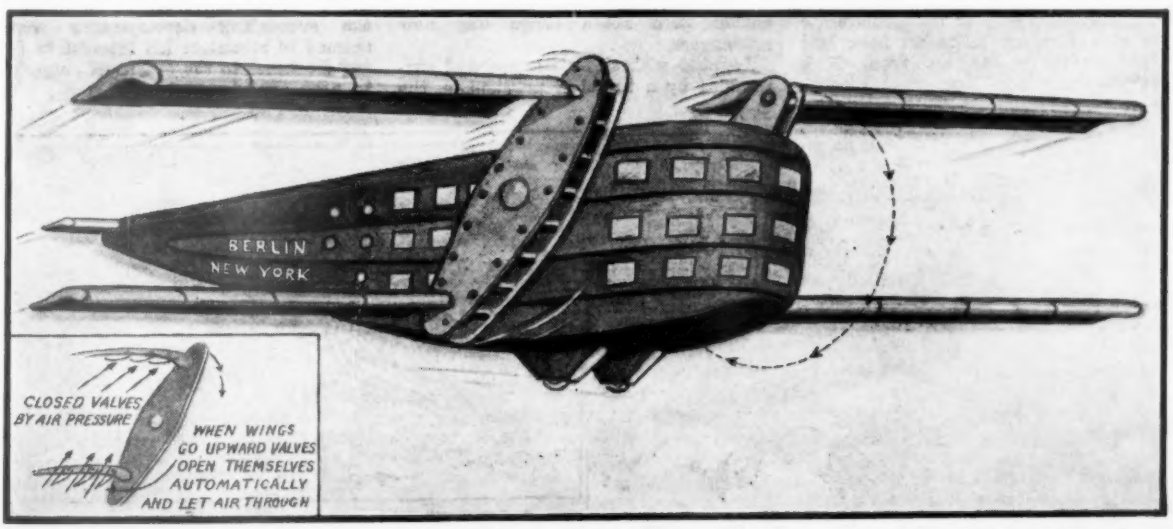
The paddles are to be driven by a 1,000 power Diesel oil engine, and with this amount of power the takeoff should be nearly vertical. This is the same amount of power installed in the paddle plane of Dr. Rohrbach described in the last issue of POPULAR AVIATION, so that it will be easy to make comparisons between the two systems of paddle wheel flight. The estimated speeds are the same, notably, 300 m.p.h.

In general, the two paddle ships bear the same relation to the Autogiro as the Mississippi sidewheelers bear to a screw propeller boat. Instead of the rotor surfaces acting along a spiral incline as with the propeller, the paddle wheelers drive down on the air directly, and this is believed to add considerably to the efficiency of flight.

As with the helicopter, the paddle wheel ships will have the ability to hover over a fixed spot and it is believed that this ability will be more marked with the paddle wheel system than with a lifting screw. In any event, it is not believed that there will be any lateral upsetting moments to encounter with the paddles as is the case with the blades of a lifting screw due to the machine travelling forward. Longitudinal equilibrium is not so certain.

By means of the longitudinal controls it will be possible to raise or lower the nose of the craft so that the angle of attack can be varied for quick take-off or ordinary flying conditions. However, no remarks have been made concerning the effects of engine torque on the fore-and-aft balance of the machine. There must be a very considerable longitudinal upsetting torque because of the low speed of the paddle shaft and apparently nothing has been done to counteract this moment.

A little study will show that the lift of the paddles increases rapidly when the ship is moving forward, because the paddles advancing into the translational air stream move at a much greater air speed than when the ship is standing still, and also for the reason that the retreating paddles move at a reduced air speed, except through a short arc at the extreme rear point of travel.


BERLIN
NEW YORK
CLOSED VALVES BY AIR PRESSURE
WHEN WINGS GO UPWARD VALVES OPEN THEMSELVES AUTOMATICALLY AND LET AIR THROUGH

Diagramatic representation of the latest type of air-paddler ship now under development in Germany. The revolving wings are "valved" like the valve feathers of a flying bird.

Edison's Early Dream Ships

by EDWIN W. TEALE

Interesting notes on Edison's early ideas on the conquest of the air, which, of course, was by means of electrically propelled craft of the flapping wing type. It is possible that these dreams are what led to the development of the Edison lightweight storage battery.

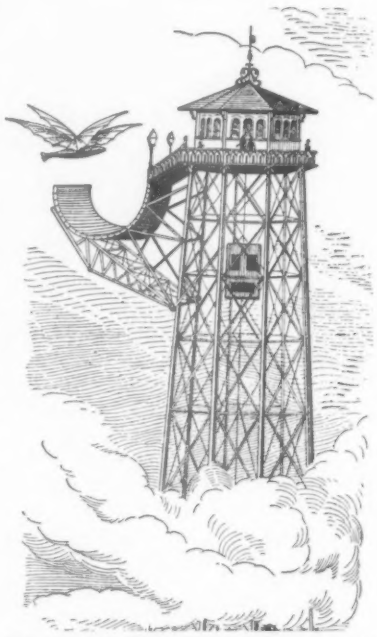
HERE is the great-grandaddy of all amphibians as pictured in the New York Daily Graphic in the year 1880.

It was in that year the news leaked out that Thomas A. Edison was working on plans for a flying machine. The Wizard of Menlo Park had just produced two of his greatest inventions, the phonograph and the electric light and when it was announced that he would make an attempt to conquer the air as well, excitement ran high.

Among the articles printed at the time about "Edison's airship" was the one in the *Daily Graphic*, which I recently found reproduced, together with the original drawing, in an old French book, "*La Navigation Aerienne*," which I picked up in a second-hand bookstore in New York City. The volume was printed in Paris before the Wrights first flew.

The article appeared as an interview with Edison. It reported he had in mind a featherweight "flying canoe" which would be borne aloft by two bat-like wings operated by electric motors. Silk stretched over a bamboo framework would form the lifting surfaces and the aerial boat would be steered from side to side by means of of a bird-like tail at the rear. The cigar-shaped body would hold two passengers and be able to come down either on land or water.

Later, the article went on, Edison hoped to build a giant six-winged craft, which could land on rough seas if necessary, for flights across the ocean. Such a machine, driven by silent electric motors, would rush through the sky at a hundred miles an hour and would carry passengers from New York to Paris non-stop.



This unique landing tower, projecting above the clouds, rather suggests that stratospheric flying had occupied Edison's attention.

Weird skyscraper landing towers were included as a possible feature of such an airline. These huge pylons of steel, rising above the lower clouds, would carry at their tops waiting depots and strange spoon-like landing cradles into which the big machines would settle at the end of a flight, and from which they would take off again, loaded with fresh cargo and new passengers.

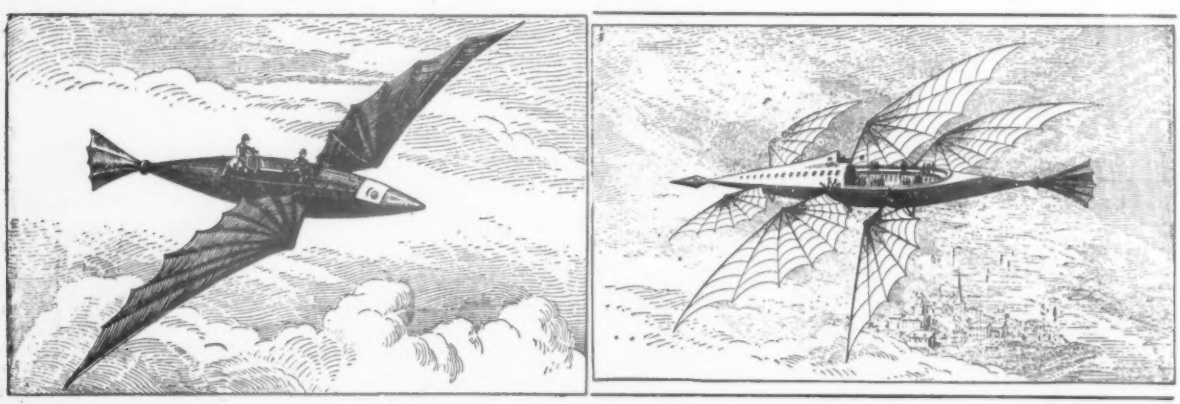
Lighted with electric lamps and surrounded by a railed-in promenade, the octagonal waiting room at the top of the tower would provide shelter and refreshments for incoming and outgoing passengers. Electric elevators would make rapid trips up and down the tower.

Some months after the Daily Graphic article appeared, Edison stated that the reporter had exaggerated the plans he had in mind. However, it is still an unsolved puzzle just how much of the weird project was the product of the reporter's imagination and how much actually represented Thomas A. Edison's 1880 idea of what 1933 airplanes would be like.

Edison's trend of thought was no doubt more or less influenced by the projects of Krebs who had endeavored to propel a dirigible by means of electric motors and storage batteries at about this time. Apparently, Edison's interest was more along the lines of developing new outlets for electric motors than it was in the problem of flight itself.

In his visions, Edison could see ornithopter flying machines propelled by super-light weight motors and batteries instead of by the steam power rigs that were so prevalent during his time. The shape of the wings and the form of the body show little originality which naturally suggests the idea that his mind was confined to the motive power.

He soon gave up this idea, and during the remainder of his life was never noticeably interested in air navigation. The success of the Wright Brothers and the succeeding developments never seemed to stimulate his interest in flying machines to the extent of engaging in aero experimental work.



And here are the weird looking electro-mechanical birds that appared in Edison's visions. The simple monoplane at the left is a classy craft for private use, while the six winger at the right was Edison's idea of a commercial transport.

Dream Ships by Our Dreamers

In this department, you can let your imagination go wild and submit that ship which you believe is the ideal for your purpose or for any other purpose. We solicit contributions.

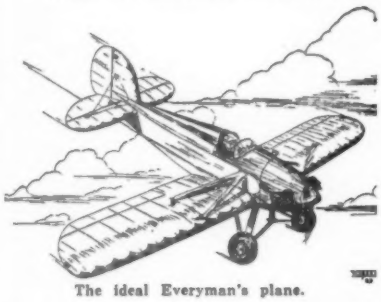
Good Morning, Dreamers

WELL, we have had a whole quota of dream ships this month, in fact they have been coming in at the rate of five or six letters per day until the office is well nigh flooded.

Most of them are very fine, but it will take some time before we can run through the batch now on hand. Therefore, if your dream is not printed right away, just be patient.

If it finally gets to the point where we cannot possibly hope to print all of them, together with the new ones coming in, we will be compelled to start weeding them out, showing only the best ones in the collection. In such an event, the names of all the other contributors will be listed without the pictures.

Wm. C. Drake Dreams

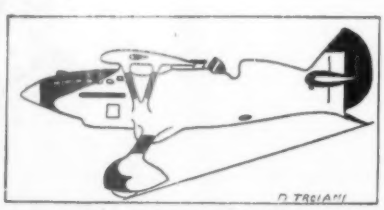


The ideal Everyman's plane.

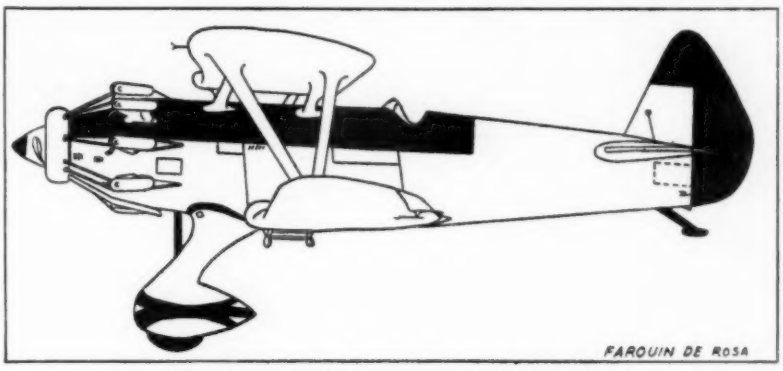
WM. C. DRAKE, 123 Clifton St., Malden, Mass., took out the old pipe the other evening and did a little dreaming, the results of which are shown by a neat little sketch. He says: "Enclosed you will find my sketch of what an ideal every-mans' plane should look like." Well, well, so this is what it looks like, boys! We're mighty glad to have a peek anyway.

Well Played, Troiani!

OUR friend and reader, D. Troiana, like DeRosa, is getting ready for war, and this is what he evidently dreams of flying in the fracas. Pretty nifty and glad to see the liquid cooled engine below, it's a change from the air-coolers.



Troiana becomes militaristic.



DeRosa's ideal fighting plane savors of the Fairey ship.

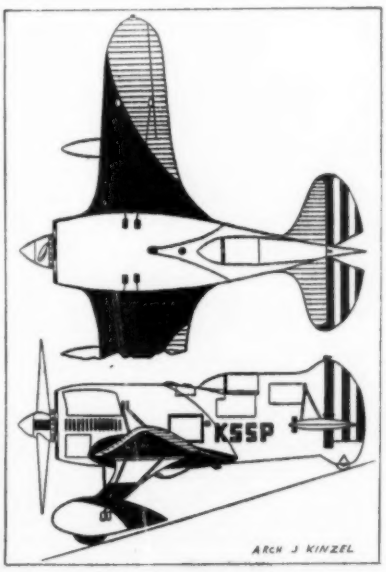
MR. DEROSA is an ambitious dreamer for he has dreamed out the details of the snappy looking military plane shown here. Either Mr. DeRosa has aspirations toward government contracting or else he is planning to start a war of his own.

This is really a nice looking biplane having certain pronounced British characteristics, a long thin tapering body, a sharp nose and a deep dihedral angle. Dream on, DeRosa, mebbe they'll start that war, we hope that you equip about 200 squadrons with DeRosas.

Kinzel's Speedy Dream

ARCH J. KINSEL dreams of the day when he can fly this low-winger winger around the pylons to victory. Mighty pretty ship, A. J. K., but we're wondering about that "KSSP" painted on the side of the fuselage. The outlines of the body suggest the shape of a streamline strut which we are not so sure is proper for a racer.

Of course, the pilot sits back near the tail which is not ideal for piloting, but perhaps he also pilots in his dreams like the designer.

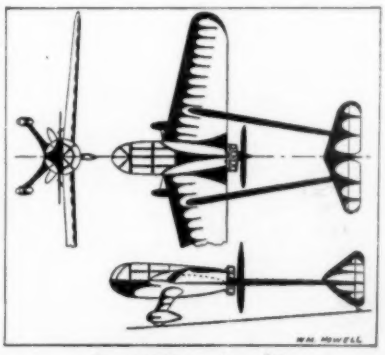


Isn't this a snappy crate?

The Dolphin Pusher

AFTER dreaming for four years (We trust not continuously), William T. Howell, Jr., 1718 Parker Ave., Detroit, Mich., has put his visions into definite shape and presents the drawings of a pusher which he has named the "Dolphin." It is crammed with visibility, we might point out, and from a look at the windows overhead we judge that it would be good for studying astronomy or star-gazing in company with a congenial co-pilot.

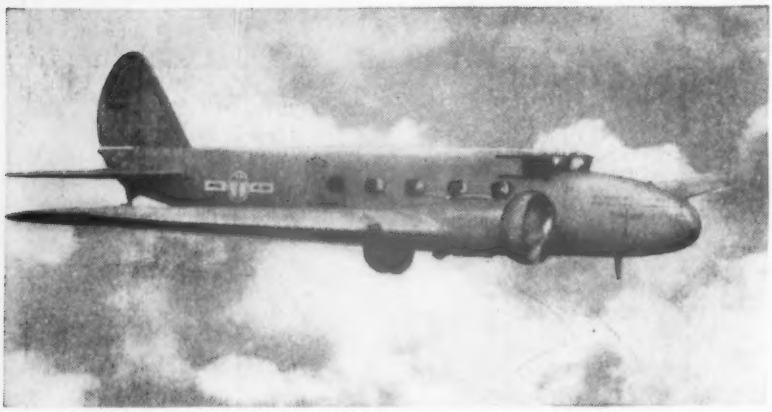
Now, Mr. Howell has gone several steps further than most of our dreamers and has constructed a flying scale model of the dream pusher. He has found that with only two strands of ⅛ inch flat rubber, it travels about 40 per cent farther than any other model with the same power. We might suggest that there would be a further conservation of power if the tail booms were parallel to the centerline.



The Dolphin pusher ship.

The Latest Boeing

by
TECHNICAL
STAFF
Boeing Airplane Company



A view of the Boeing Low-Wing Twin-Engined Transport plane in flight on the United Air Lines.

AN entirely new type of commercial transport plane has just been tested out by the Boeing Airplane Company, Seattle, Wash. This is an all-metal low-wing monoplane provided with twin engines. It is said to be one of the fastest planes of its kind in the world.

It represents the recent tendency toward the employment of a twin-engined ship instead of the conventional trimotor type now usual for a plane of this size. It is powered with two 550 h.p. Supercharged Wasp engines, and with the exception of the plywood used for the cabin insulation and flooring, is built entirely of metal. Sixty of these planes are being produced for the United Air Lines and the general market.

It carries ten passengers, a crew of three and has a big reserve for miscellaneous cargo. The performance figures released by the Boeing Airplane Company after the final tests are as follows:

PERFORMANCE DATA

Top speed (@ 5,000 feet)	182 m.p.h.
Cruising speed	165 m.p.h.
Landing speed	58 m.p.h.
Takeoff run	770 feet
Initial rate of climb from sealevel	830 f.p.m.
Climb in 10 minutes	8,000 feet
Service ceiling	18,000 feet
Absolute ceiling	20,000 feet
Cruising radius without refueling	660 miles

As will be seen from the accompanying photographs, this transport is of clean design without external structural members. Retractable landing gear has been fitted which alone adds several miles per hour to the speed and correspondingly cuts down the fuel consumption. Without a doubt, this medium size transport is a most economical and efficient type for high speed scheduled operation.

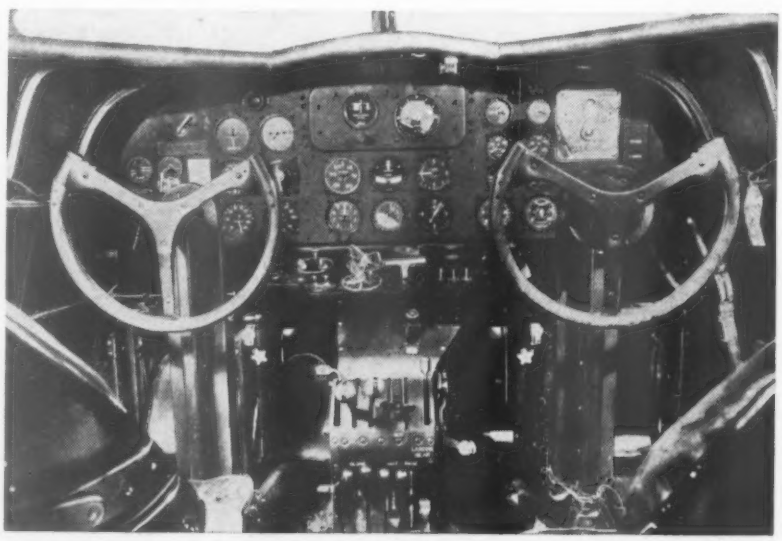
The cabin of the new liner, 20 feet long and 6 feet high, has a row of five chairs on either side of the aisle. The seats, with their adjustable reclining backs, are deeply upholstered, are 20 inches wide between the arms and are spaced forty inches apart. Comfort features include a liquid heating system for winter, cooling system for summer, main and individual ventilators, dome lights, individual reading lamps, lavatory facilities, a wide window at each chair and cabin insulation against both noise and temperature conditions.

The wall of the cabin consists of the outside metal skin, a half-inch air space, a thin layer of felt, a sheet of plywood and, as the interior finish, a layer of felted fabric. This latter layer reduces so-called reflected sound. Further, the location of the engines, forward of the leading edge of the wing without direct connection to the body, is a factor in the reduction of both noise and vibration.

A thermostatically controlled heating-cooling system is designed to maintain a temperature of about seventy degrees in the cabin, regardless of outside conditions. Units of the system include a boiler built around one exhaust pipe, air scoops, radiators and blowers. Air passing over the radiators is heated before going into the cabin through individual ducts beside each seat. For cooling, the processes are reversed. The boiler is automatically disconnected from the exhaust and the air is cooled as it enters the plane. Approximately 18,000 cubic feet of air an hour is fed into the cabin. In addition, there are individual air intakes at each window which are adjustable by passengers.

The cabin interior is as distinctive in appearance as it is comfortable, with fixtures of statuary bronze, upholstery of green whipcord and the cabin wall lining of green fabric. The plane's exterior is silver grey—a tone produced by anodic treatment rather than paint.

Back of the passenger cabin and lavatory is a mail-baggage compartment of 65 cubic feet in size, while in the nose is a roomy mail pit of 60 cubic feet. The forward mail pit is

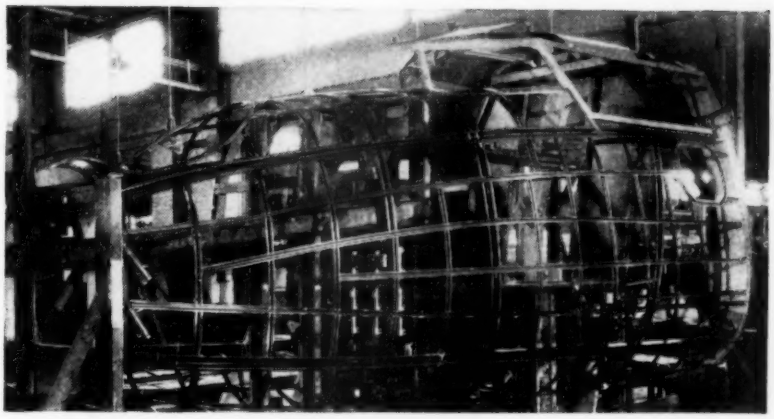


A look into the pilot's compartment showing the dual controls, the instrument board, radio equipment and electrical features. A maze of gadgets for the pilot.

Low-Wing Transport

GREAT interest attaches to the appearance of the new Boeing transport planes, both in point of design and in respect to the large number now being put into production.

They indicate the present trend away from the tri-motor type and toward the twin-engine unit. Many interesting details have been introduced through the extended experience of this company.



Structural details of the body, a veritable bridge construction of great strength and rigidity. Many special jigs and fixtures were required for putting this frame into mass production.

accessible by means of a hinged door in the nose; the passenger cabin is reached through a door in the right side of the fuselage and the rear mail-baggage compartment is entered through a door in the left side of the fuselage. The door arrangement is such that mail and cargo may be loaded and unloaded without interfering with passengers. This feature is expected to be important at air terminals where quick dispatch is the order.

The pilots' compartment, entered through a door from the cabin, shows the result of close consideration for the flyers' needs, with the provision of virtually every device of proven value to aid in the plane's operation and navigation. There are dual controls, a main instrument board with thirty-five different devices and a sub-panel. The two receivers and transmitter of the standard two-way radio telephone equipment are located just ahead of the pilots' compartment. The first pilot's seat is adjustable in flight. Unusual visibility is afforded the pilots because of the location of the compartment ahead of the wing, away from the motors.

As a result of the long experience of United Air Lines in transport operation, the instrument installation represents the very last word. Of the instruments provided, there are three sets whose functions are duplicated, including the directional gyro and compass; the sensitive altimeter, recording elevation in hundreds as well as thousands of feet, the rate of climb indicator and turn-and-bank indicator and the artificial horizon.

Other devices are the air-speed indicator, clock, landing gear position indicator, outside air temperature gauge, engine cylinder temperature gauge, multi-point selector switch for cylinder temperature readings, two hydrostatic fuel gauge dials, dual engine primer, parking brake lever, switches, controls, lights and electrical units, fuel pressure gauges, oil pressure gauges, oil temperature gauges, electric tachometers and an ammeter.

To eliminate the hazard of landing with the gear in retracted position, three warning devices are provided. On the instrument board are the landing gear position indicator and two red bullseye lights which flash in the event the throttle is closed with the gear up. On the wall in back of the pilot's head is a Klaxon which sounds at the same time that the lights flash.

In place of the customary venturi tubes, an engine-driven vacuum pump is used for the plane's vacuum-operated instruments. This was chosen as a means of eliminating the drag of the venturis as well as the hazard of their becoming clogged with ice. Standard night flying equipment includes navigation lights, landing lights in the leading edge of the wing and parachute flares.

The nacelles holding the two Wasp engines are bolted to the wing structure. Boeing ring cowls and Hamilton three-bladed propellers are used.

Throughout, the transport is a sturdy construction of the semi-monocoque type. Duralumin bulkheads, longerons, skin stiffeners and skin covering make up the fuselage. The 74-foot cantilever type wing consists of spar trusses of square and rectangular aluminum alloy tubing, ribs, and the smooth metal skin. It is in five sections—center, two outboard panels, bolted to the wing stubs outboard of the engine nacelles and the wing tips. The trailing edge of the wing, the leading edge of the wing stubs and the wing tips are removable to facilitate repairs. Cantilever type tail surfaces are used, with front and rear spars braced with ribs (channel section) and smooth metal skin covering.

Special Boeing-patented trailing edge flaps are used. This is something new in commercial air transport design for

The seating accommodations in the passenger compartment of the low-wing Boeing transport plane Note the excellent arrangement of the windows.

the elevators and rudder to provide for trimming the plane in flight and for correction of unbalanced propeller thrust. The stabilizer is non-adjustable, being fixed to give proper balance at cruising speed with full load.

The landing gear is retractable into the wing stub, and is operated electrically with an auxiliary manual control. Only sixteen seconds are required to retract the gear and less than twenty seconds to return it to normal landing position. The gear is of the divided type, equipped with Boeing oleo shock absorbers and hydraulic brakes which may be operated either simultaneously or individually. The brakes may be locked for parking by means of a hand-operated ratchet.

The large low-pressure main tires have a tread of fifteen inches and carry only 25 pounds of air each, while the tail wheel tire, with a tread of seven inches, carries 30 pounds of air. The tail wheel is full swiveling and is equipped with an oleo shock absorber.

Fuel tanks, located in the wing stubs on either side of the fuselage, have a total capacity of 265 gallons, permitting a cruising range of at least 660 miles.

Performance figures on the new plane speak for themselves as to speed. The high strength factors built into the monoplane were revealed in static tests, with a number of the main parts exceeding even the rigid requirements of the Department of Commerce, thus permitting an increase in payload. As evidence of this strength, the wing is designed to withstand a load of 36½ tons and the landing gear a load of 32¼ tons.

Because the plane was built to the needs of air transport operators, its features of operating economy are many. All-metal construction means a minimum of maintenance and repair; there are the factors of more miles an hour and extended cruising range with a low fuel consumption; parts have been so designed that they are easily accessible for maintenance and inspection and all the main divisions of one plane are interchangeable with those of another as the result of the Boeing company's careful tooling for the project. Included are such items as wing sections, body sections, tail surfaces, landing gears, doors, floors, windows, engine mounts, etc.

United Air Lines officials have announced that, with the speedy equipment, coast-to-coast travel time will be reduced to less than 24 hours and similar reductions will be made on the company's other lines. The cruising range of the plane, it is reported, will make possible flights between the Pacific and Atlantic seaboards with only seven stops, as against the present fourteen.

SPECIFICATIONS

Wing span	74	feet
Wing area (Incl. aileron)	836.13	s. ft.
Stabilizer area	73.8	sq. ft.
Elevator area	58.9	sq. ft.
Fin area	17.6	sq. ft.
Rudder area	24.1	sq. ft.
Aileron area	62.6	sq. ft.
Length overall	51 ft. 4	in.
Height (Incl. radio mast)	16	feet

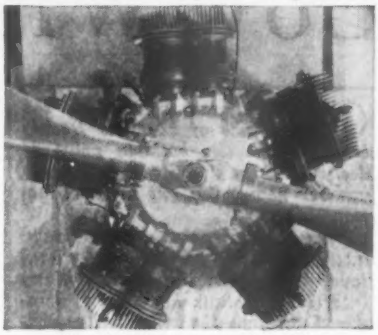
Only men acquainted with tooling for the mass production of an intricate machine can appreciate the amount of work involved in designing the tools, dies, jigs and fixtures for these planes. The necessity of standardizing the shop practice and design in order to insure interchangeability of the various parts introduced a difficult engineering problem.

This is in distinction to airplane manufacture as it has commonly been carried out in many plants. The majority of ships are built one by one, mostly by hand methods, simply for the reason that the demand for the ships was limited. The total result of this condition was difficulty in getting spares and replacements quickly when they were needed.

With 60 planes in the first production, and with a prospect of many more to come, it is possible for the Boeing Airplane Company to adopt many of the methods pursued by automobile manufacturers and others to give rapid service to the operators on lines where the planes were to be used.

A group of the new Boeing transport planes in the course of assembly. Note the interior wing construction at the end of the wing stub.

New Two-Cycle Engine



The Blue-Streak two-cycle engine.

Another two-cycle engine, the Blue-Streak, has been built and has successfully passed severe tests. It is unique in the fact that it carries five groups of two cylinders each arranged radially around the crankcase.

It develops 100 h.p. at 1,800 r.p.m. and has more than 100 hours to its credit. The makers claim that it is the first two-cycle engine to successfully fly an airplane to a height of 19,000 feet.

It has no valves nor valve gear to cause trouble and has only a comparatively few working parts. This is one advantageous characteristic of the two-cycle engine on which many inventors have been working. With five operating cylinders, the working impulses per revolution are equal to a 10 cylinder four-cycle engine.

Air Corps Organization Nears Completion

ON March first, Assistant Secretary of War for Air, F. Trubee Davison, announced the approval of orders for the early organization of five additional pursuit squadrons, which writes the closing chapter—with respect to the number of Air Corps fighting units—of the Army air expansion program adopted in 1926.

When Mr. Davison took office in July, 1926, the Army Air Corps consisted of 32 squadrons equipped with planes which included a large percentage of obsolete war-time ships. Now—with the five new pursuit squadrons just authorized—the Army air organization will consist of 51 squadrons of modern military aircraft, divided as follows: 21 Pursuit squadrons; 12 Bombardment squadrons; 4 Attack squadrons and 14 Observation squadrons.

"Due to the shortage of planes and pilots, brought about by demands imposed by economy," said Mr. Davison, "a few of the organizations are operating at reduced strength. These reduced units will be raised to their full strength with respect to planes and personnel as soon as conditions permit.

"There have been times when it seemed as if the expansion of our air defenses progressed with very lagging steps indeed. Therefore, the organization of these last remaining fighting units is to me a source of great satisfaction."

L. A. A. Chairman Airs Views

by LESLIE LONG

The Chairman of the proposed lightplane association makes some pertinent remarks upon factors governing the organization. Our membership is growing rapidly and now's the time to wrangle out the details.

AS OUR new Association takes form, there are several definite problems to consider.

Of course, there will be a flood of names suggested, one of which will have to be chosen. Personally, I think the name should be rather short and to the point. The word "Association" is long and tiresome. The word "League" is neater and serves as well. I fail to see how we could select a much better name than *AMATEUR AIRCRAFT LEAGUE*. It tells the story and doesn't take all day to write or pronounce.

Mr. Rathbun brings up the question of power limitation. This is pertinent —quite so, in fact. There is considerable chance of an argument developing over the thing. Right here I am going to state my personal convictions, the ones I have held and worked for during the past four years. I will probably get razzed, but it must be done.

So far as the social, business and scientific angles go there is no need to even mention power limitation. Any owner of any type of airplane should be eligible. On the legal side, though, there is a different story.

Basically, this League is being formed for one purpose only, the removal of unjust and unwise legal restrictions. We must have one definite goal to work for to do this and we must all work as a unit toward that goal. It would be folly to demand one thing in one state and something else in another.

The principal arguments of those who promote the restricting laws are based on "the safety of our youth" and the "good of aviation." Neither of the arguments is valid, but they do the work, as we too well know.

When cornered one of these "anti" men ramble along about like this: "— and so, this boy built his haywire crate and after getting out of a lot of scrapes by fool luck he put his girl in it, just to show how good he was. Of course he piled the thing up. The girl was killed and he walked out of it. Are yuh gonna let this sort of thing continue ——?" And so on, and so on.

He is partly right. There seems a sort of fate that decrees that the pilot walks out and the innocent passenger doesn't. This gives our enemies the strongest and only real argument they have against unrestricted private flying.

I HAVE always felt that we should limit our demands for flying freedom to single place ships. There can be no danger that way. Nobody's boy or girl, who would know little about flying, is going to get hurt and there will be much less danger of over-loaded ships. One should and must have the right to risk his own safety, but not that of others, especially where so much is at stake.

Gentlemen, I sincerely hope you will agree to this. I know from much personal experience that it makes our position far more secure in every way. Some present designs will have to be altered by removing the extra seat, but that is little to do.

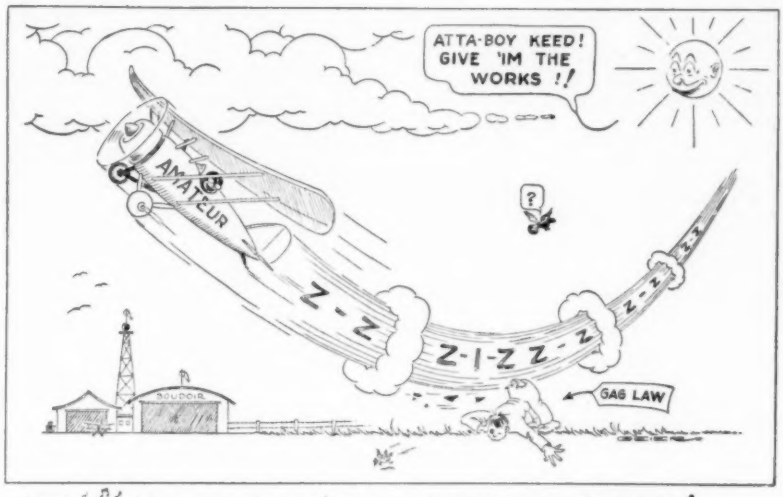
As we all know, the real motive behind restrictive legislation is business. In spite of all the proof to the contrary, many of the commercial manufacturers and operators think if we are prevented from building and flying our own that we will promptly buy or rent ships from them. As to that, it is certain that we won't.

However, we can remove the greater part of this type of opposition by limiting ourselves to low-powered, single-place ships. The fact that we can not carry our air-minded friend is quite apt to make him go and buy a ride. Since we couldn't do any private and unlawful instructing on the side, our friend must go where he should go for his instructions. This all means business for the commercial operator and he should welcome it. After all, we must have him, you know.

If, after this we can further convince the commercial man that every amateur builder is a definite prospect later on, I sincerely believe that we can just about remove our greatest menace. In reality, our crowd would be the minor "League" from which the big commercial "League" will draw its recruits in the future.

AND now, another ticklish subject— the afore-mentioned power limitation. All great progress has come through working against odds. It is only when we have a definite task to overcome that we get anywhere. We are lightplane men, or we have no excuse for existence. The other side has run away with power already.

Anyway, it is futile for us to start low and gradually work towards a goal



OH COME, ALL YE FAITHFUL AMATEURS, LET'S GET GOING!

—Cartoon by Irving Geier, Member L.A.A.

POPULAR AVIATION,
608 S. Dearborn St.,
Chicago, Ill.

PRESENT MEMBERSHIP 151
349 yet to go to reach 500
Sign up today!

Gentlemen:

I enclose one dollar ($1.00) herewith for one year's membership dues in the lightplane association now being organized.

NAME.....

STREET OR R. F. D.....

CITY.....*STATE*.....

of seeing how much horsepower we can get into the air. That is exactly what has happened in the past. The late Ed. Heath was the only manufacturer who stuck steadfastly to the true light-plane. There is no progress for us in simply adding more power everytime we make a change in our ships.

It is far more worthy to develop a ship that will fly safely at 65 miles per hour, carrying 35 pounds per horse power, than to build one that will fly 165 and carry but 10 pounds. On the one side lies safety and low cost; on the other danger and expense. This applies to us as amateurs. Commercial speed is another matter.

From the beginning, I have steadily advocated a limit of 50 brake-horsepower for unrestricted experimental solo ships. I hope you will agree with me again. I even wish you would agree to lower it to 40 horsepower. It would be better for all of us. You have no idea what will happen in the fields of efficiency if all experimenters are limited to a definite power.

Loads up to 60 pounds per horsepower will be common within a short time. This is exactly what happened in amateur radio. A few years ago, the authorities thought they could get entirely rid of the amateurs by putting them down on the then useless wavelength of 200 meters. The result was that in a very short time the boys had made 200 meters the most valuable band in use.

FROM long experience with lawmakers and commercial interests I feel certain that we will have the greatest chance of early success if we simply ask each state for the right to lawfully fly under the following limitations:

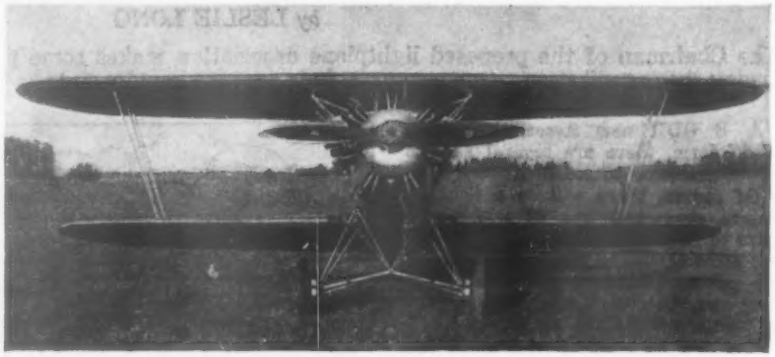
The ship must have no more than 50 B.H.P. It must seat pilot only. It must not carry any material of any kind for hire. It must not be rented for hire. It must fly from private fields only, must observe the established rules of flying and must bear a Department of Commerce Identification Number.

The pilot must hold a license either (a) a Federal Solo License, or (b) a State Solo License, or (c) must demonstrate to the State Board his ability to handle an airplane.

If we limit ourselves this way, we can win in a short time. There is no question about it. When the time comes, we can ask for more and expect to get it if we deserve it. Two years ago I had an amendment introduced at our state legislature, written exactly as above and it passed both Houses with entire approval. Really, there is nothing for anyone to object to.

I earnestly ask your approval of this outline. The power includes all the standard light engines now in use, and will prevent the building of dangerous racers that can do no good. The limitation to pilot only cuts out all danger of danger to others, and the consequent liability to criminal action against us, as well as leading to better relations with the commercial people. I feel sure this is the right road.

Details of the Swedish Tiger-Swallow



Front elevation of the Swedish Tiger-Swallow built for advanced flight training.

THE "Tiger-Swallow," latest product of the Aktiebolaget Svenska Jarnvagsverkstaderna which has so long specialized in machines for Arctic work, represents not only the latest European technique in this line, but is also an airplane specially qualified for advanced training purposes.

It is a two-seater biplane of such sturdy construction as to be almost crash-proof. One of them came down on a snow covered lake in Smaland recently with a force that would have wrecked an ordinary machine and then turned over twice without any more damage than the breakage of the propeller.

Its characteristics have been studied with special reference to advanced training purposes. In addition to good climb and speed it is very light on the controls. The ailerons are controlled both by stick and by a torque tube in the lower wing which has a sharp stagger to facilitate the best possible overhead view. The fuel system is fitted with a special tank to permit inverted flying for long periods.

The great strength of the machine is due to the use of tubes and sheets of Swedish nickel chrome steel.

This steel has a tensile strength almost triple that of the tubing and sheet used in most airplanes.

The "Tiger-Swallow" is fitted with a 250 h.p. Walter Castor I motor.

SPECIFICATIONS

Wing spread	27½ feet
Length	21½ feet
Total surface	217 sq. feet
Useful load	771 lbs.

PERFORMANCE

Speed at ground level	127 m.p.h.
Climb to 2000 meters (6500 feet)	3 minutes
Climb to 4000 meters (13,000 feet)	16 minutes
Ceiling	22,000 feet

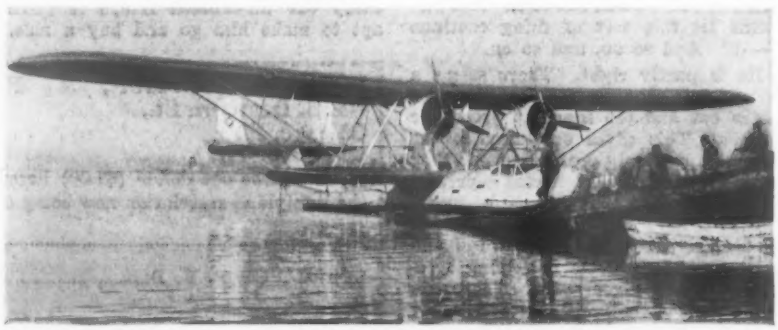
Plane for Colombian Government

HERE is a view of the big amphibian built for the Colombian government.

This amphibian has a wing span of 100 feet and is propelled by two Wright Cyclone engines. The gas tank capacity is 1200 gallons which gives the ship a cruising radius of 1000 miles at a speed of 100 m. p. h.

On its long flight home, this amphibian broke, by several hours, Lindbergh's record made on his celebrated "Good Will Tour" of the South American countries.

It is claimed that the ship takes off in a remarkably short distance and that it lands on and taxies over rough water with very little difficulty.



The amphibian built in the United States for the Columbian Government.

Notes on the Heinkel Transport

by OSCAR E. BRAUN

A new product of clean design built by the Ernst Heinkel Airplane Works, Warnemuende, Germany. It has many unique points.

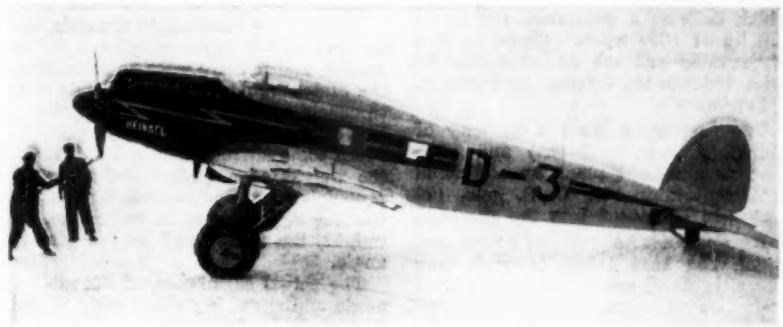
THE Ernst Heinkel Flugzeugwerke, Warnemuende, Germany, the designer and constructor of the remarkable He-64 sportplane, which did well during last year's Europa contest—has brought out the first European high speed transport.

This very interesting design has been developed for the Deutsche Lufthansa A. G., and will fly on their main routes. The new Heinkel is a cantilever monoplane of the low wing type with accommodation for seven persons. The landing gear and tail skid, as well as the Glycol radiator, are retractable.

The monocoupe all-dural fuselage has an oval section and shows a remarkably clean design. It has been built up with circular bulkheads and longerons running through the whole body, so that no structural parts are projecting into the spacious cabin. Only countersunk rivets have been used for the dural planking and no rivets can be seen on the outside.

Non-shatterable curved glass has been used for all windows, the glass being closed up flush with the fuselage surface. The same refers to a wide door located on the right side, where even a countersunk door handle has been provided.

The engine bed is mounted to the forward frame and can be removed quickly by loosening four bolts. A fireproof oil-tight bulkhead with asbestos protection is placed in front of the pilot's compartment, the seat being arranged slightly higher so that the pilot will have excellent vision in all directions. The seat can be adjusted vertically when flying, while a horizontal adjusting device may be moved on the ground.



Side elevation of the Heinkel transport showing the typical slender tapering fuselage of the Heinkel ships.

The pilot's cab has a streamlined cover sliding to the rear. The side walls of the pilot's cab have been designed partly as windows and the left side may be let down so that easy access is permitted. However, the main entrance for the crew, consisting of pilot and radio operator, is on the starboard side, where a sufficiently large door is located above the wing root.

A bulkhead separates the operator's compartment from the cabin lying close behind. This wall has a draftproof slide window, which may be opened from the cabin as well as from the pilot's cab. The cabin is free from all noticeable vibration and very quiet.

A wide window is located at the side of each seat, thus allowing excellent vision over the scenery. Both forward windows may be opened easily and all are sufficiently large to be used as emergency exits. The cabin is well ventilated and heated and an adjustable air flap has been installed at the side of each seat.

The cantilever wing with diminishing chord, thickness and curvature has a slightly negative V-shape at the root. It has been designed in one unit with two box-spars, spruce girders and plywood webs. The ribs are spaced closely and the wing is entirely planked with plywood to increase torsional rigidity.

The spars will be inserted in two cut-outs in the fuselage and fastened by a number of bolts. Two fuel tanks are placed into the wing near the fuselage and may be removed easily. The spars running through the fuselage are protected in such a way that no damage may occur to the passengers.

Similar to the wings, the cantilever tail plane has an elliptical contour. Structurally the tails is built up in the same way as the wings, with wooden spars, ribs and plywood planking.

The fin and stabilizer are connected to the fuselage rigidly and an auxiliary rudder at the elevator has been used for trimming. This auxiliary rudder is easily adjustable from the pilot's seat by means of a hand lever.

The retracting problem has been solved in a very ingenious manner so that the wheels will be housed entirely by the wings. The mechanism is such that the wheels are attached to a support strut sliding on a rail into the wing with its free end. By moving this free end of the strut, the wheel is drawn into the wing by a cable.

Contrary to some other designs, this arrangement allows the use of a normal shock absorber strut with a long stroke. The cut-outs in the wing are closed automatically after lifting the wheels and a signalling mechanism

Nose and landing gear of Heinkel transport. The landing gear is retractable, the wheel swinging up into the circular opening in the wing.

shows the position of the wheels. Compressed oil in cylinders with pistons is used for the retracting mechanism.

The tail skid has an oleo shock absorber and withdraws into the tail together with the landing gear automatically by means of hydraulic pressure.

The Heinkel He-70 is powered by an B.M.W. VI engine without gearing, which delivers a maximum output of 630 hp at 1600 r.p.m. Glycol cooling is provided and the radiator may be retracted into the fuselage by means of a handle.

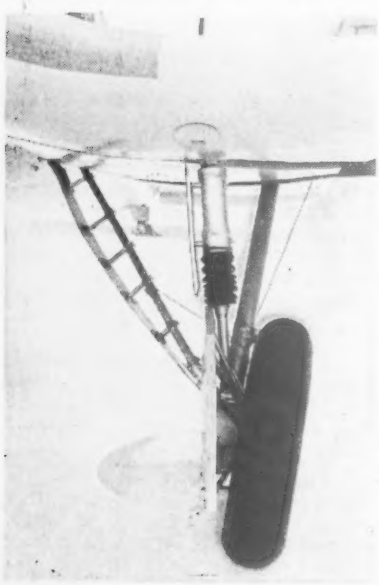
The fuel tanks have a capacity of 114 U. S. gals. (430 ltr.) and when used as a freight plane an additional tank containing 18.5 U. S. gals. (70 ltr.) will be placed into the fuselage.

Its clean design and the great care which has been taken to avoid any parasitic drag makes the plane very fast. A maximum speed of 226.25 m.p.h. has been shown on its first trial flights. It must be added, that this excellent result has been certified and measured officially by the D.V.L. (Deutsche Versuchsanstalt fur Luftfahrt).

The chief pilot of the Heinkel company, Warner Junck, with a payload of 1100 lbs. over a triangle course of 62.5 miles reached nearly 208 m.p.h. (348.1 km/h) while the former record for planes of its class is in the neighborhood of 186 m.p.h.

SPECIFICATIONS

Span	48 ft. 5 in.
Length over all	37 ft. 8 in
Height	10 ft. 2 in.
Wing Area	392.9 sq. ft.
Weight empty	5060 lbs.
Useful load	2222 lbs.
Payload	1100 lbs.
Total gross weight	7282 lbs.
Number of passengers	5 persons
Crew	2 persons



Details of the Heinkel retractable landing gear.

Question and Answer Department

All questions of general interest on any phase of aviation will be answered authoritatively by POPULAR AVIATION'S Technical Staff.

QUESTION:—A. T. T., Portland, Ore. *How is the gliding angle and gliding speed determined?*

Answer:—PRIMARILY, the gliding angle depends upon the relation of the resistance to the weight, and if there were no resistance, the glider would continue to glide continuously without losing any elevation. However, resistance is always present, hence some altitude will be lost. Since the weight of a glider constitutes its propulsive force it is evident that the less the resistance is in respect to the weight, the flatter will be the gliding angle.

The actual calculation of the gliding angle and speed is far too complicated to describe in detail in this column, and we suggest that you consult some textbook for further explanation.

* * *

QUESTION:—D. D. N., Madison, Wis. *Why do the inner portions of a propeller blade form a greater angle with the flight path than the parts of the blade near the tips?*

Answer:—WHEN the ship is in flight, the propeller blades travel in two paths at the same time. The blades travel in a circle and at the same time are moving ahead in a straight line. The face of the blade is therefore at varying angles, at a greater angle near the hub because it rotates here in a smaller circle but at the same time must advance as far forward as the rest of the prop. Near the tips, the circular velocity is greater, hence the angle of the tips is reduced.

* * *

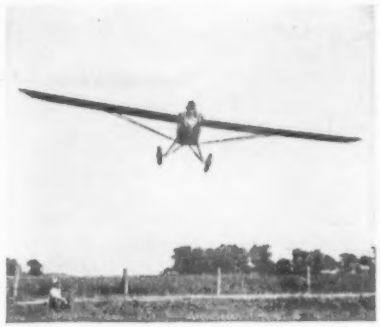
QUESTION:—W. T. D., Syracuse, N. Y. *Is there much advantage in the use of heavy fuel oil from the standpoint of the weight of fuel carried for a certain distance?*

Answer:—LIGHT gasoline carries more heat energy per pound than fuel oil, but the fuel oil carries more heat per gallon than gasoline for the very reason that there is more combustible material in a heavy oil. With engines of equal efficiency, five pounds of gasoline would carry the ship further than five pounds of fuel oil. Measuring by the gallon, the fuel oil would weigh more and consume more power for its support but at the same time it would produce more power, and there you are.

* * *

QUESTION:—A. W. R., Mendota, Ill. *In the old "shoulder control" ships, how were the various controls handled and connected?*

Answer:—THE pilot sat in a chair with a pivoted back and arms. This chair back was connected to the ailerons so that when the pilot moved his shoulders, the ailerons were operated. This took the place of the stick. The elevator was controlled by a stick or lever placed in front of the pilot, while the rudder wheel was mounted on top of this stick.



Lightplane gliding to a landing under the influence of gravity.

* * *

QUESTION:—DeW. B. F., Fresno, Cal. *How is the power of an aviation powerplant calculated when the plane is to be lifted to a given height? Is the power calculated in the same way as for lifting a weight through a given distance?*

Answer:—THE power required for lifting an airplane to a given height is complicated by the fact that the airplane must be driven forward at the same time that it is climbing. Thus, the resistance and forward speed enter the problem as well as the energy applied for lifting the ship.

* * *

QUESTION:—A. L. M., Lexington, Ky. *When the word "helix" is used in respect to a propeller, does this mean that it is a special kind of prop?*

Answer:—NO. This word is derived from the word "helix" which is the name of the curve described by a point on the propeller blade when it is rotating and moving forward at the same time. A common example of a helix or helical curve is the curve of the threads on a machine screw.

* * *

QUESTION:—H. R. S., Bechley, W. Va. *I read in the article, "Two Parachutes Better Than One," that anyone who has*

(*Concluded on page* 397)

This ship is propelled by fuel oil carried in pontoons.

The Case Against Tri-motors

by DOUGLAS ROLFE

Illustrated by the author

"Two's company, three's a crowd," claims our author, particularly when applied to the powerplants of airplanes. Big engines and fewer of them is the solution according to Mr. Rolfe.

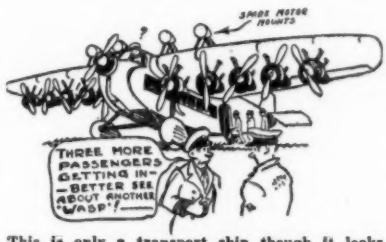
WHY do manufacturers build tri-motor airplanes? And what prompted the belief that of all airplanes this type is the safest? Experience certainly does not check up with this popular hallucination.

Several interesting theories have been advanced on this subject, the most plausible of which runs to the effect that a certain designer once found himself the happy possessor of three engines and only enough material to build one airplane. Being shy on aerodynamics and a bear for performance, he decided to make a Christmas tree of the job and hang all three kickers along the wings, hoping thereby to electrify the aviation world with the daring and audacity of his scheme. But even with all of the hardware hung in place, nothing much happened except bigger and better crashes.

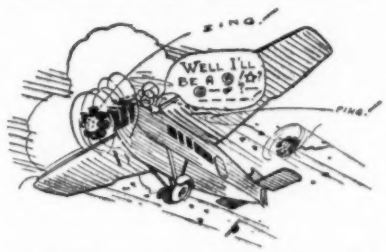
The extraordinary position of importance which the tri-motor assumed some years ago, and still largely maintains, is a tribute to the lack of constructive imagination displayed by some of our leading designers. And this lack of originality, in turn can be attributed to conditions surrounding the development and re-birth of aviation following Lindbergh's transatlantic flight. In the mad haste and turmoil a whole lot of foolish gestures were made in aviation somewhat after the following manner:

Perhaps one of the most striking aftermaths of Charles Lindbergh's successful transatlantic flight was the remarkable change which occurred in the public's estimate of flying in general and of the airplane in particular. Hitherto regarded with apathy or as a thoroughly dangerous and unnecessary contraption—a spectacular affair which the newspapers quite justly treated in a purely sensational manner—the airplane was soon to be respected as a sort of magic carpet.

To be sure, this sort of thing had occurred before. An examination of the history of powered flight will reveal at least one or two instances of a similar public reaction to some spectacular flight. In the main it can be said that these booms have been more harmful than beneficial but the one we are considering now, the Lindbergh boom as it might be termed, not only differed from all previous manifestations in its sheer intensity but it also did something else—it paved the way for commercial aviation as we understand it today. All at once people became "air-minded."



This is only a transport ship though it looks like an engine storage house. Why not use spares, says Mr. Rolfe, to meet varying loads?



"Imagine my embarrassment when all three of the kickers fell off," remarks Shorty Schroeder. This is one time when extra engines meant nothing at all.

"Designers and pseudo-designers dusted off their drawing boards, took out their slide rules and proceeded to do dreadful things."

"—but suppose the engine should stop!" Trying to sell the pilot on a brand new idea. "Use more motors and you'll never come down with engine trouble."

STARVING pilots, bankrupt manufacturers and all the run of hangers-on in aviation came suddenly into a new importance and an unexpected prosperity. Established designers dusted off their drawing boards, took out their slide rules and proceeded, in most cases, to do dreadful things. A new class of pseudo-designers sprang up and proceeded to do still more dreadful things.

In all the land there was a rushing to and fro as all sorts of people, including bankers (an entirely new phenomenon be it remarked), hastened to profit from the amazing discovery that they too could be pioneers in the newly dawned aerial age. A halo of glory hung over the revived industry.

With all these manifestations of a changing public attitude towards the airplane it is not surprising that the old layman's prejudices and fallacies began to wilt and disappear.

For instance, that bothersome question of "what happens when the engine stops?" continued to exercise the public mind and in justice to this mind it must be said that this is an intelligent question. The pilot's explanation that engine failure means a gentle glide to the surface of the earth rather than an abrupt plunge out of control may be satisfactory to a few but motor failure was a problem of first importance and fear to the majority of the public.

THEREFORE, when Mr. Fokker happened to hang a couple of extra motors and propellers on a perfectly good Fokker monoplane, it is easy to believe that this abortion was immediately hailed as *"A GREAT STEP FORWARD"* by literally millions of people who followed the "What-happens-when-the-motor-stops" School of Thought.

Now they had an adequate solution to their fearful question—the riddle was solved. When the engine stopped, the ship just proceeded on the other two engines and everything was lovely. Of course, there still remained the possibility that the other engines might also stop but it was generally believed that a safe landing could be effected before this unlikely situation assumed disastrous proportions.

What might happen if all three engines stopped simultaneously was another matter. Being so improbable it never seriously entered people's minds and could in any case be attributed to an "act of God" to which most everyone would be cheerfully resigned.

Born then, as it was, at a time when

the public interest was at a new peak; a time when the early passenger airlines were getting under way and creating a lively demand for ships of large carrying capacity, it is not surprising to find that the tri-motor soon became a familiar sight in the skies. And when one considers that multi-power in itself suggests security, it is but a short step to the public's conclusion that the word "tri-motor" and safety are synonymous.

Apart from these considerations, I find it difficult to comprehend why the public so casually accepted the tri-motor as the symbol of aerial safety and I would dearly like to know just what grounds there are for believing it to be safer than other types of planes.

In this connection, it would be interesting to examine the records of the Department of Commerce and see how fancy lines up with fact. Certainly there have been accidents involving tri-motor ships—plenty of them—many of them of a serious nature. Some apparently resulted primarily from engine trouble of one sort or another, which brings us to an important consideration.

Is the average fully loaded tri-motor, having a wing engine cut out while taking off or turning close to the ground, in any happier or even *safer* condition than a single engine job would be in similar circumstances?

Most manufacturers of tri-motors claim that their product will fly and climb on two motors. This presumably means with full load and with any combination of two motors. Otherwise the claim would be of much less importance. But, granting these claims to be 100 per cent valid, what about a sudden engine failure, a wing engine, let us say, in any of the situations outlined in the previous paragraph? The point is, that it is from precisely such situations that most serious accidents develop.

IN straight flight there are many well authenticated cases where a tri-motor plane has landed without incident after one or more of its motors has ceased functioning or worse. A notable example is that of the Northwest Airways ship which dropped an entire wing engine and flew on to a safe landing—to its destination in fact. Unfortunately for my convictions I do not know how many passengers it was carrying at the time but I suspect that the ship in question was not carrying a full load.

Major ("Shorty") Schroeder once lost all three engines. They dropped off one after another and sadly disarranged the landing gear during the process. It must have been a time of considerable emotion for Schroeder. At any rate, the fact that he landed safely

(*Concluded on page* 395)

The Aero Sportswomen

by JOAN THOMAS

LAURETTE SCHIMMOLER, who gave up poultry raising to pilot planes, who was the first woman to manage a flying field and who is now vice-president of the Vi-Airways at the Cleveland airport, was an official delegate to the Conference on Airport Management and Finance at Columbus, Ohio.

The invitation to this gathering of airport executives is indeed an honor, but one that is well deserved. There is scarcely a point in the financing, building and management of a flying terminal that Lorette Schimmoler is not equipped to understand and discuss. For almost single-handed she rescued the Port Bucyrus field from a political demise.

Three years ago, the citizens of Bucyrus, Ohio, voted a $40,000 bond issue to purchase and equip an airport. The newly elected mayor, however, consistently opposed spending the money. The City Council nevertheless sold $15,000 worth of the bond issue, but even with the money in the bank, the mayor vetoed the ordinance to purchase the airport.

At this point, Lorette Schimmoler assumed command of the fight with the financial backing of a number of the local business men. She leased the airport, built a new steel fireproof hangar and had the field tiled and reconditioned. Then she induced the flying school from which she had graduated to move there from another city, and it was reorganized as the Bucyrus Institute of Aviation. Today Port Bucyrus offers complete service to air traffic under the management of Miss Schimmoler through an assistant trained by her.

Before she took up flying, Miss Schimmoler had held other responsible positions ranging from court stenographer, real estate selling and advertising to chicken raising. She at one time owned and managed a Leghorn

National headquarters of the "99," an association of women pilots at Cleveland, Ohio. Amelia Earhart, the president, is shown at the center of the group.

farm which supplied the eggs for the commissary department of a large national railroad system.

In connection with her work at the Vi-Airways she has charge of all women's activities at the Cleveland airport. Last fall, she established the first official headquarters for the "Ninety-Nine," a national organization of women pilots headed by Amelia Earhart. Early in December Miss Earhart winging her way across the country, dropped down to a call on Miss Schimmoler and officially hung the emblem of the 99's in the new headquarters.

All women flyers, whether members of the organization or not, are cordially invited to visit and make use of the Headquarters whenever they are in Cleveland.

* * *

AT least two attempts to better Amy Johnson's Cape Town record have ended in spectacular desert rescues, but up to the present, Miss Johnson is still Britain's premiere woman flyer.

(*Concluded on page* 394)

Two well known women flyers are shown here. Mrs. Marsalis, second from the left and Mrs. Louise Thaden are holders of the women's endurance flight record.

Landing by Radio Beams

Landing blind by means of a speciál control at the airport is now made possible by a new system of radio beams devised by the Department of Commerce.

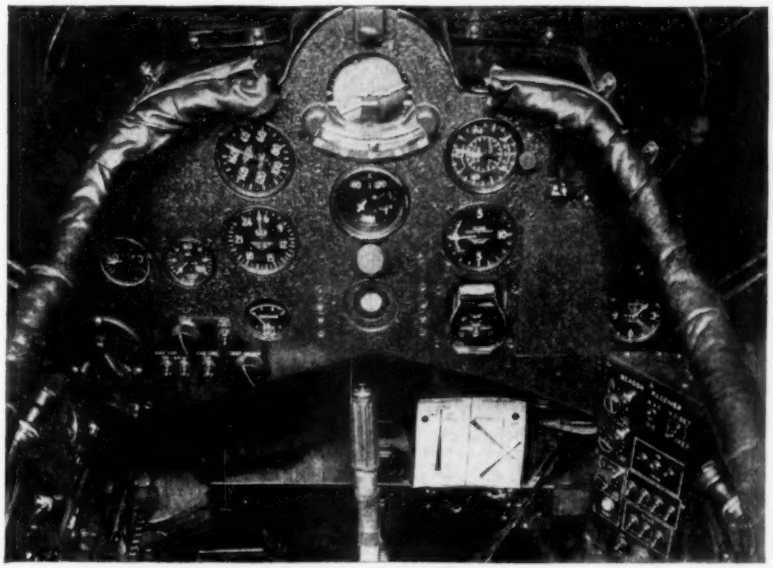
BLIND landing of airplanes by radio directional guidance has reached the stage of development by the Aeronautics Branch of the Department of Commerce which permits use of the equipment at a busy terminal airport for service tests under actual working conditions involving fog and other conditions of poor or zero visibility.

This radio system for blind landing of aircraft has been developed by the Aeronautics Branch through its Aeronautics Research Division organized at the Bureau of Standards. It makes a completely blind landing possible, but the system will seldom be subjected to so stringent a test in actual practice as visibility is not often so poor that the pilot cannot see the ground just before landing.

The installation for service tests at the Newark Airport will be available for the use of airplanes equipped with the necessary radio receiving apparatus. The major part of the equipment required aboard the aircraft is the standard set used for listening to weather broadcasts and for receiving signals of the visual type radio range beacon in flying along the airways. The additional equipment required is quite simple and weighs about 15 pounds.

As now constituted, the radio system for blind landing of aircraft gives direction in three dimensions—lateral, longitudinal and vertical. This is the information that the pilot must have to make a landing. Lateral direction is given by a runway localizing beacon, longitudinal direction by marker beacons, and vertical guidance by a landing beam.

Landing, according to the directions of these radio aids, is accomplished in the usual manner, with the difference that the pilot, instead of orienting himself by watching the horizon and the ground beneath him, guides his plane by watching the dials on his instrument board and listening for the signals of the marker beacons through his headphones.



View in the cockpit of a ship equipped with the new radio landing apparatus. The pilot's receiver is shown in the lower right hand corner of the picture.

Approaching an airport during a period of no visibility, the airman follows the main radio range beacon, which may be either the visual or aural type. If he is following a course marked by a visual beacon the indicator used is a needle on a dial. As long as he is on his course, the needle points vertically to the middle of the dial, but if he deviates to the right or left the needle swings to the corresponding side of the dial. For following the aural beacon, the pilot listens to dot-dash signals in his headphones.

When the pilot reaches the immediate vicinity of the airport and passes directly over the radio range beacon transmitting station, his receiving apparatus indicates this fact. He then retunes his set to the frequency of the runway beacon and makes a wide circle of the field in a counterclockwise direction in order to pick up the signals of the runway beacon. He also throws a switch which places a second receiving set in operation to pick up the signals of the landing beam.

The runway beacon is a small radio range beacon, similar to the main radio range beacon, but operating at low power and giving extremely accurate directional service along the airport runway and for a few miles beyond.

To follow the signals of the runway beacon, the pilot watches the same needle that he has been using in connection with the main radio range beacon. As before, the needle points vertically to the middle of the dial to show on course, and to the left or right to show deviations from the true course.

Upon orienting himself along the runway course—generally 3 to 5 miles from the field—the pilot begins to make use

(*Concluded on page* 395)

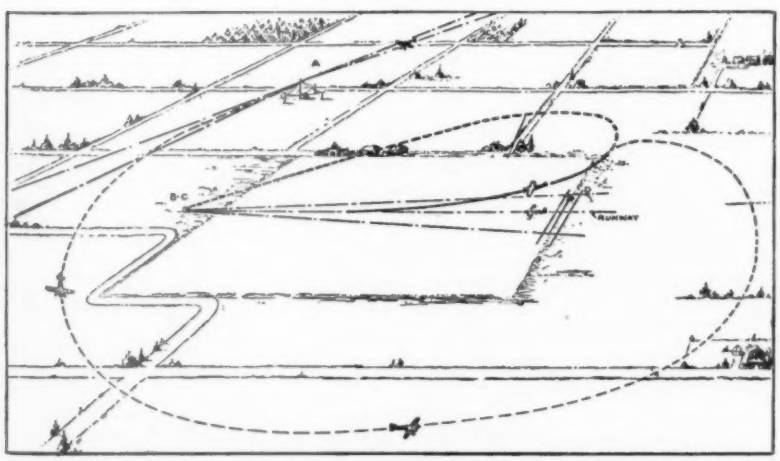


Diagram of an airplane landing by means of the radio system. The beam of the main radio range beacon is (A), while (B) and (C) the runway localizing and landing beam. The marker beacon is at (D).

A Collection of Historic Lockheeds

Here are the four famous Lockheed planes, side-by-side in front of ahe Lockheed factory.

IT HAPPENED that four of the most famous Lockheed ships were brought into the factory at the same time for repairs, hence the panoramic view shown here.

Reading from left to right, they are: Amelia Earhart's Lockheed Vega in which she flew across the Atlantic, second from left is Lindbergh's Lockheed Sirius in which Lindbergh and his wife flew to the Orient, next is Wiley Post's "Winnie Mae" in which Post and Gatty flew around the world and, finally, Hal Roach's Lockheed Orion which is on a round-the-world-business trip. This is a historical lineup.

In the following list is a more complete record of the planes shown by the picture in which the record breaking trips are reviewed.

(1) AMELIA EARHART. Solo flight from Harbor Grace, Newfoundland, to Londonderry, Ireland, May 20-21, 1932. Time 13 hours, 40 minutes.

(2) CHARLES A. LINDBERGH. One stop flight from Glendale, Calif., to Roosevelt Field, New York, accompanied by Mrs. Lindbergh, April 20, 1930. Time, 14 hours, 45 minutes, 32 seconds.

(3) WILEY POST. Around the world in 8 days, 15 hours, 51 minutes. Flight started June 23, 1931.

(4) HAL ROACH. A 16,500 mile flight to South America in 96 hours, flying at an average rate of 174 m.p.h.

Some Details Concerning the Douglas 0-35 Army Plane

(See Front Cover)

ON the cover of this month's issue, Herman Bollin has drawn an action picture of the Douglas O-35 Army plane in flight. As shown on the cover the ship is about to make a landing with the landing gear wheels extended, but in flight, the wheels are fully retracted.

Now, the Douglas O-35 is classified as a "long range reconnaissance ship," or as an "Army" observation ship to distinguish it from the "Corps" observation type which is something distinctly different. The photograph below, very kindly supplied by the U. S. Army Air Corps and marked for equipment by the builders of the ship shows the prominent details very clearly. When certain very slight changes are made, this becomes the "Douglas B-7" which is classified as a "light-bomber."

SPECIFICATIONS

Wing span	65 in. 0 ft.
Wing Chord	10 in. 2 ft
Wing section (airfoil)	N-22
Wing area	621.2 sq. ft.
Aileron area	62.4 sq. ft.
Angle of incidence	0 degrees
Dihedral angle	2 degrese
Crew	3 men
Power-plant	2 Curtiss Conquerors

First of all, it is the gull wing type so favored in Douglas monoplane construction, the "V" between the wings giving the observer a good view to the rear from his pulpit in the nose of the ship.

Both the Curtiss Conqueror engines are placed very close to the body with only a small clearance for the three-bladed propellers. The engine nacelles are of the streamline type located just above the landing wheels.

The sides of the fuselage and the vertical fin are covered with corrugated metal, while the nose and the engine nacelles are covered with plain flat sheet.

—*U. S. Army Air Corps Photo*

Detailed view of the Douglas O-35 Observation, also known as the Douglas B-7 when equipped as a light-bomber.

Standard Flying Stunts

by LAWRENCE J. LESH

Here we find the method of properly performing four of the best known stunts, the Wing-Over, the Split "S", the Falling Leaf and the Immelman Turn.

WING-OVERS are used as a fast reverse direction turn. They provide good practice in reverse control flying and are neither dangerous nor violent as plenty of flying speed is maintained throughout.

A wing-over consists of dropping the nose below the horizon to gain a little additional speed, gently pulling the stick back until the ship is in about a 60° climb, kicking right or left rudder at the top and banking enough at the same time to make the turn smooth. The wing will drop in the direction the rudder is applied and the nose will start down when the ship has reversed its direction.

The stick should then be pulled back to bring the nose up level with the horizon. The motor can be left at cruising speed throughout this maneuver. The wing-over might be described as a climbing turn followed by a diving turn.

Some pilots execute what is termed a "split-S-turn" and think they are doing a wing-over, so I will next describe a split-S-turn so you may readily see the difference.

To do a split-S-turn, bring the nose of the ship up until it is pointing straight for the sky, hold it in this position just long enough to lose most of your flying speed, then kick rudder hard in either direction. The wing will drop in the direction rudder is applied and the nose will start down describing a pin wheel effect.

When the nose is straight down, the stick should be pulled back, rudder taken off and normal flight resumed. The motor may be kept open until the nose starts down, then the throttle should be closed until the nose comes up to level flight when it is opened again to maintain speed. You will find at the completion of this maneuver that you have described a 180° turn just the same as in the wing-over.

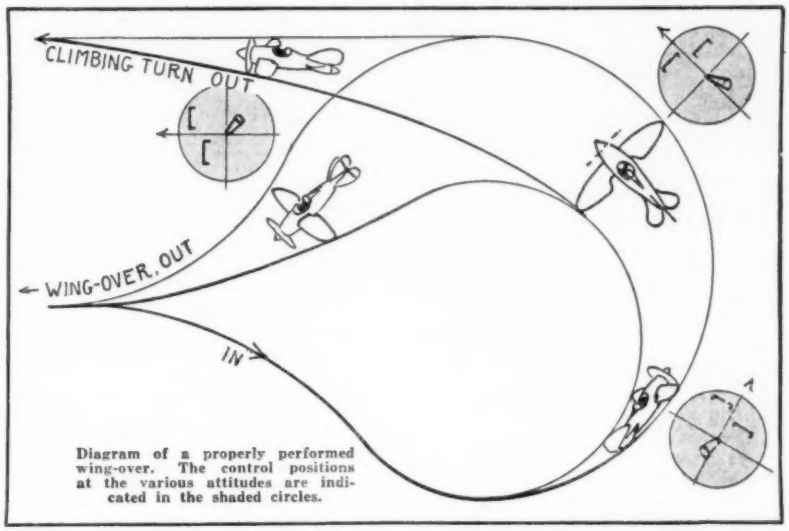


Diagram of a properly performed wing-over. The control positions at the various attitudes are indicated in the shaded circles.

In executing the split-S-turn, pilots often let the ship get partly on its back and again others don't pull it up quite so steeply. The correct split-S-turn is carried out when the ship is put in a position vertical to the ground and then pulled up into normal flying position.

The "falling leaf" is a spectacular maneuver. It is difficult and very dangerous as the ship is on the verge of a spin all the time. I never will forget the time I first tried this stunt. I was up about 1,000 feet and I started to do what I thought was the right thing, whereupon I was in a spin so quick it started to make my head go around.

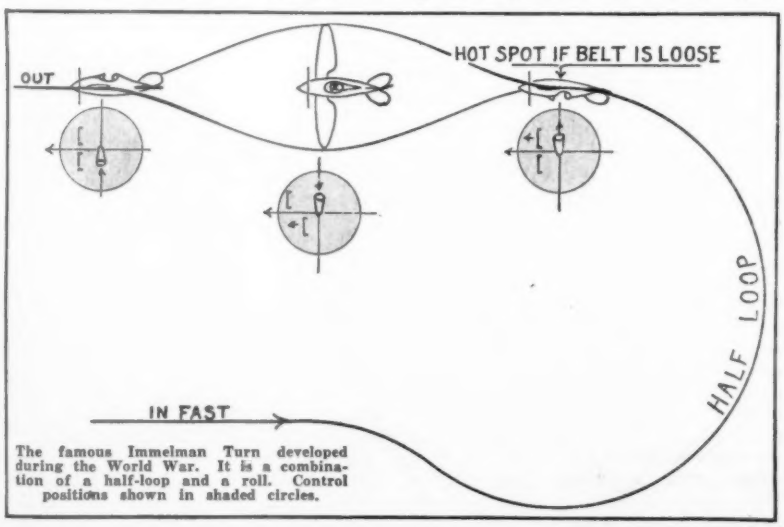
It happened so fast that, before I had time to recover and get the ship straightened out, I was below the tree tops. I trust you will take care and not repeat my experience. The Department of Commerce has since passed a Regulation that no acrobatics be done at less than 1500 feet.

To do a falling leaf, bring the nose up above the horizon about 20° or 25° with the motor off and hold until ship stalls, then as ship starts to stall start one wing down in a slip. After the ship starts down hold stick fairly well back and kick top rudder. The downward motion will slow up and stop. The ship will come level, climb a little and then the opposite wing will start down.

The same thing is done again, that is wait until ship has started to slip down then apply top rudder during the swing, etc. As soon as the desired altitude is reached, the nose can be dropped below the horizon and rudder neutralized to maintain a straight path.

On account of the low flying speed, aileron action will be quite ineffective during the falling leaf. As in control during a stall, the rudder is most important for lateral control. Kicking high rudder on the side slip speeds up the wing on the low side and prevents a spin or turning dive.

The Immelman turn is next in order and, as there are several ways of doing this, I will describe each of them. The correct procedure is the one I will describe first. Dive the ship for speed, as in a loop, and continue until you



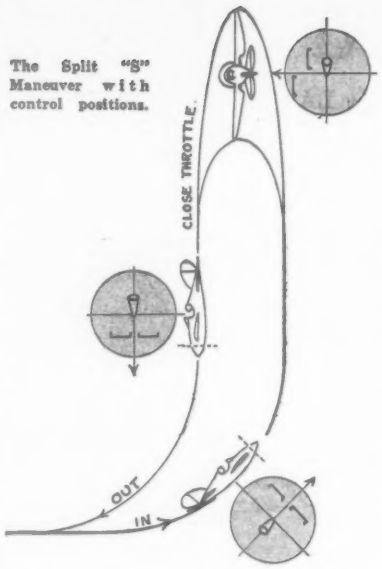
The famous Immelman Turn developed during the World War. It is a combination of a half-loop and a roll. Control positions shown in shaded circles.

are up-side-down with the nose on the horizon. Then, push the stick forward to neutral, at the same time applying hard aileron in the direction that the roll is desired. As the ship starts to roll right-side-up, and a vertical wing position is reached, top rudder is to be used to keep nose on the horizon until ship comes right-side-up.

Another way is to begin as above, but just before you are up-side-down and start to roll out, pull the stick back hard to the right hand corner and apply full rudder in that direction. The effect will be part of a snap roll, but it leaves you without speed and at the stalled position when recovery is made right-side-up. It also will be hard to recover right-side-up properly with this procedure.

A third way, and one that I like, seems like a climbing turn. Dive the ship for speed, pull back on the stick until the nose is about 80° above the horizon, drop one wing and apply rudder until ship is level and 180° turn is described. Then level out ship and neutralize the controls. Considerable altitude can be obtained with the procedure with plenty of flying speed all the way around, and it makes a very fast reversal of direction.

The vertical roll, or upward spin, is a stunt that requires plenty of speed and power. The more power the better and inasmuch as there are very few pilots that have ships available to do this stunt I will not say much about it. There is, however, a vertical roll that can be done with a low powered ship and I will describe this to you.



The Split "S" Maneuver with control positions.

First be sure that you have a ship that can stand a stiff dive. Place the ship in a dive until plenty of speed is obtained, then pull the nose up until it is in about a 70° or 80° climb. Watch your air-speed and when it drops down to around 90 miles per hour, move the controls for a snap roll. You will feel the ship rotate and see it revolve.

When the nose comes around it should be slightly above the horizon, then pull the stick back to continue your climb at the 80° angle just long enough to make it look like an upward spin. Level out very quickly as you will be on the verge of a stall and to continue on would be a spin. This maneuver looks well from the ground.

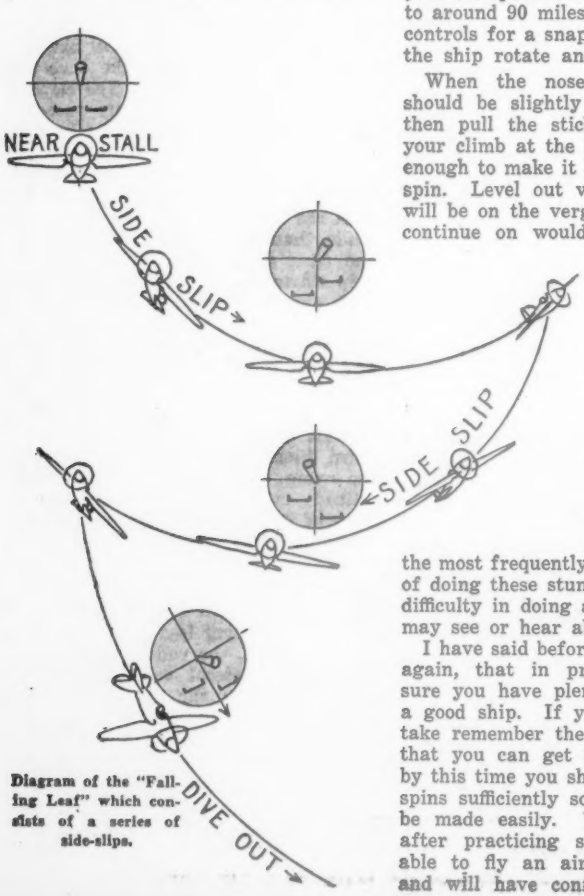


Diagram of the "Falling Leaf" which consists of a series of side-slips.

There are a number of other stunts that can be executed in right-side-up flying, even some that there are no names for, but the ones that I have described are the ones used the most frequently. If you are capable of doing these stunts you will have no difficulty in doing any others that you may see or hear about.

I have said before and I want to say again, that in practicing stunts be sure you have plenty of altitude and a good ship. If you do make a mistake remember the worst predicament that you can get into is a spin and by this time you should have practiced spins sufficiently so that recovery can be made easily. You will find that after practicing stunts you will be able to fly an airplane much better and will have confidence in yourself.

How to Shut Her Off

AS A result of extensive tests on all types of aircraft engines, the Army Air Corps has concluded that the method heretofore prescribed for stopping an engine, shutting off the fuel supply and idling the engine until the carbureter empties, is out!

This results in a gradual leaning of the mixture while the carbureter level is being lowered. A lean mixture being hotter than an ordinary or rich one, the cylinder walls and valves are thus unduly heated up, while at the same time there is little air stream to cool them for the plane is standing still on the ground and the prop is barely turning over.

The Air Corps has therefore turned to the following method of stopping an engine, which will stop it in a minimum time at idling speed and also prevent kick-backs and backfires:—

1. Gradually close the throttle to normal idling position.
2. Allow the engine to run at normal idling speed for a few minutes with the nose cowl or radiator shutters, if any, fully opened and with the altitude adjustment, if any, at full rich position.
3. Cut the ignition switch and at the same time open the throttle.
4. Close the fuel supply valve.
5. Leave the throttle in the open position after stopping engine, as this lessens the likelihood of accidental starting while the engine is still hot.

There are several precautions to be observed. No attempt should be made to line up the propeller in a horizontal or any other position while the engine is still hot, due to the danger of it "kicking." Be sure that the fuel valve is turned "ON" before attempting to take off after starting the engine again, as there may be enough gas still left in the carbureter to allow a partial take-off after a quick start, resulting in the engine conking at an inopportune time. Be sure that the throttle is also closed if the engine is restarted by cranking the propeller by hand.

Many new engines have acceleration pumps in the carbureter. When the throttle is opened, a pumping device discharges a quantity of fuel into the carburetor venturi or barrel in order to provide, momentarily, a richer mixture which in turn is necessary for proper engine acceleration.

If the throttle is opened and closed several times successively while the engine is being turned over in starting it, the fuel is pumped in such quantities that it will run down into the air-intake, creating a fire hazard, particularly if the engine happens to backfire when being started.

And thus we conclude our dissertion on an operation that has indirectly led to a lot of engine trouble from time to time, and worry on the part of the inexperienced pilot. Starting and stopping an engine are directly connected, hence certain starting difficulties can be avoided by properly shutting off the engine.

How to Build the Corben Junior Ace

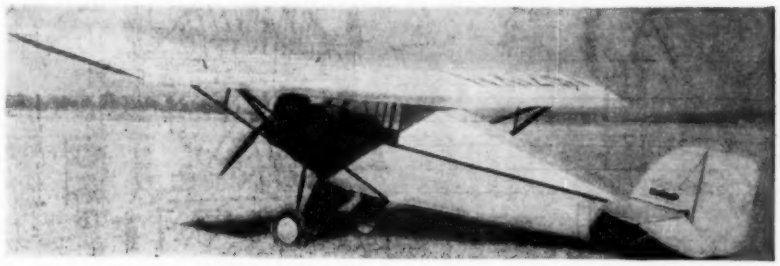
by O. G. CORBEN

PART III

Here, we conclude the construction of the wings, one of the most important parts of the ship that is fully explained by the text and the accompanying full page drawings.

IN MY last construction article, I took up the construction of the ribs and other wing details and showed the assembly of the Junior Ace wing. In this article, I will describe the remaining details and will also describe the manner of truing up the wing, which for all practical purposes, is as important as the construction of the ribs or spars.

When the framework of the wing is completed, it is to be laid aside until the other parts of the structure are finished, for the wing covering or fabric should not be applied until all the ship including the fuselage, tail group and other parts are also ready for covering. It is better to do all of the covering at one time rather than to cover the individual items as soon as they are completed. Let us now finish the remaining details.



Three-quarter rear view of the Corben Junior Ace with cabin enclosure in place. A nifty little ship.

THE NEUTRAL AXIS

Now just a short explanation of the action of the spars under stress so that a full understanding of the term "neutral axis" can be had.

When a beam, like the wing spar, is subjected to a bending stress or load, this stress is not uniformly applied all over the cross-section of the beam. If the lift is upward, as in this case, then the bottom fibers of the spar will be in "tension" or so that the load tends to pull these fibers apart. At the same time, the top of the spar is placed in "compression," or so that the load tends to squeeze the parts together at this point.

Therefore, there must be some intermediate point between the top and bottom of the spar where the compression verges into the tension stress and where neither compression nor tension will exist. This point in the spar, where there is neither tension or compression, is a horizontal line running along the length of the spar called "the neutral axis" of the spar.

The neutral axis is used as a basis for measurement on the spars and that is the reason that I have taken so much time explaining it. Since this spar is not "symmetrical" nor balanced about the neutral axis, the neutral axis does not pass through the exact center of the spar. On the front spar, the neutral axis is 2½" above the bottom of the spar while on the rear spar it is 1-31/32" from the bottom.

LAYING OUT THE SPARS

To start with, the four spars are made from ¾" selected aircraft spruce. First square off one end of each spar. These will be the "root ends" that attach to the fuselage. Now cut the proper bevel on each spar as indicated on drawing No. 600.

Measure and draw a line along the spar to represent the neutral axis, which is 2½" from the bottom of the front spar and 1-31/32" from the bottom of the rear spar. Next, lay out the spars for drilling all the holes as indicated on the details. Also lay out the location for the tie-rod end-blocks and the ribs. In making such measurements, start at the root end of the spar and work out toward the tip of the spar. Be sure that all of the dimensions check before you start drilling. Spare holes are not desirable in a wing spar.

Just note this before the drilling starts. There are two left and two right spars for each set of wings. In short, there is a right and left front spar and a right and left rear spar. Be sure that you don't forget the "hand" of the spars or you will have a lot of wasted material on your hands.

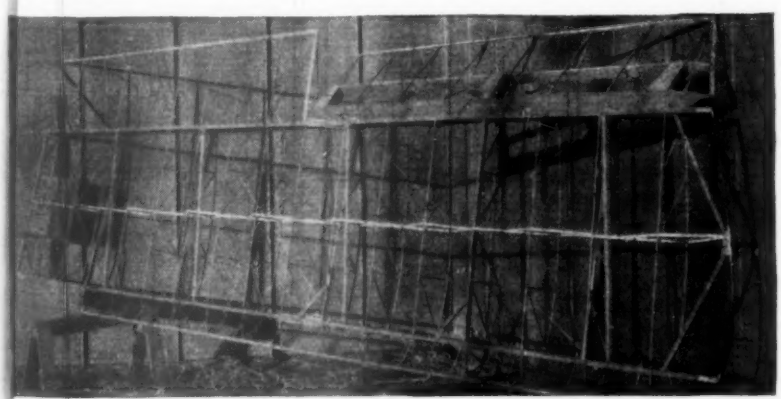
Before drilling, lay out the tips of the spars at the outer ends of the wings, always noting that you have a right and left spar for the right and left wings. Now, drill all of the holes to the proper sizes, after which you are to cut the angles at the outer tips. You can now start to assemble the wing.

Slide all of the ribs in their proper places but do not nail. Cut and fit all plywood gussets and filler blocks, nail and glue all plywood to spars as detailed on plan No. 600. Next cut your tie-rod end blocks to the sizes and angles shown. Care should be taken in getting the right angles so that there will not be any binding when the tie rods are put into place.

You will note that the ribs at the points where the tie rod blocks attach have a portion of the brace (in front of the front spar and to the rear of the rear spar) cut out to clear the tie rod block. It is necessary to drill small holes in the blocks for the nails as a small nail will bend in the maple if you don't. Nail and glue all of the tie rod blocks in their places, being sure that you put the right angle on the right side. Always work from the root end out.

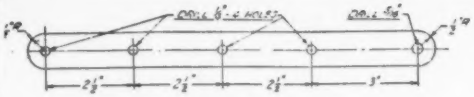
After you have all of the gussets, blocks, etc., nailed and glued in place, leave them to dry and make up the wing fittings as detailed on plan No. 601. Most of the fittings are made

(*Continued on page* 378)



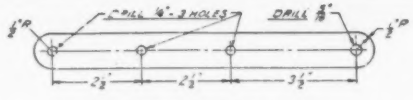
View of the wing construction completely assembled with the aileron in place and ready for covering.

NOTE: ALL BOLTS AND NUTS "AN" SPECIFICATION NICKEL STEEL. ALL FITTINGS CADMIUM PLATED.

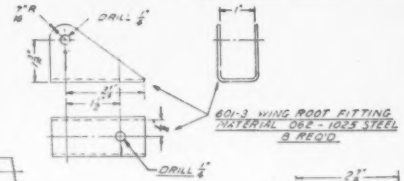


601-1 FRONT STRUT FITTING
MATERIAL .125-1025 STEEL - 4 REQ'D.

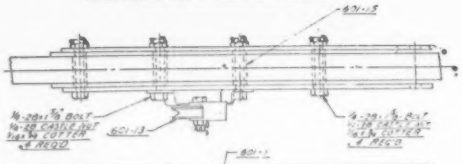
601-15 WING FITTING BUSHING
MATERIAL ½-.058-INCH TUBING
18 REQ'D.

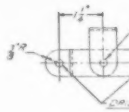


601-2 REAR STRUT FITTING
MATERIAL - 125-1025 STEEL - 4 REQ'D

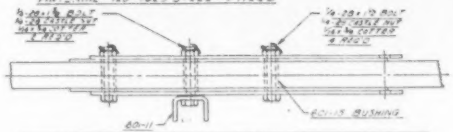


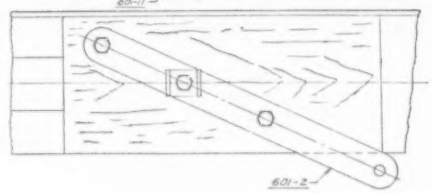
601-3 WING ROOT FITTING
MATERIAL .062 - 1025 STEEL
8 REQ'D.



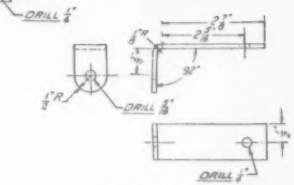


601-7 AILERON PULLEY BRACKET
MATERIAL .062 - 1025 STEEL
2 REQ'D.

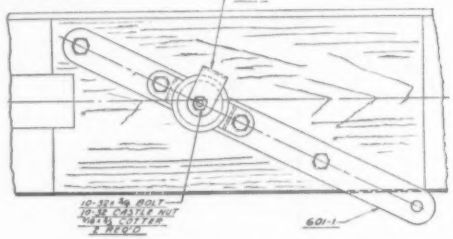




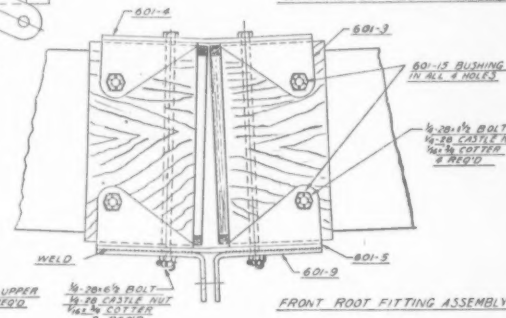
REAR STRUT FITTING ASSEMBLY
REAR VIEW -



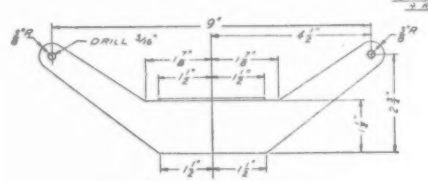
601-9 LUG - WING ROOT FITTING
MATERIAL .125 - 1025 STEEL - 4 REQ'D



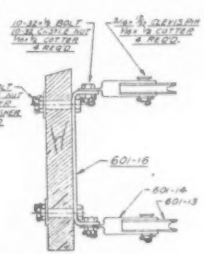
FRONT STRUT FITTING ASSEMBLY
REAR VIEW



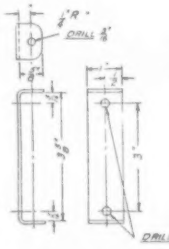
FRONT ROOT FITTING ASSEMBLY



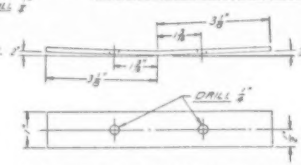
601-10 AILERON HORN - MATERIAL - 095-1025 STEEL
2 REQ'D



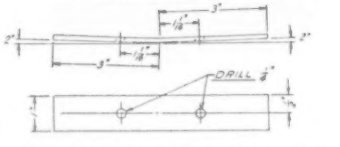
OUTBOARD AILERON PULLEYS



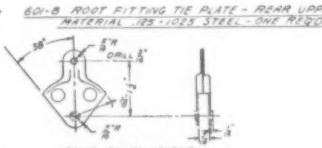
601-16 PULLEY HANGER
.125-1025 STEEL - 1 REQ'D.



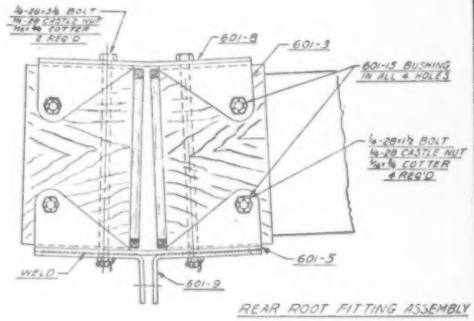
601-4 ROOT FITTING TIE PLATE - FRONT UPPER
MATERIAL .125-1025 STEEL ONE REQ'D.



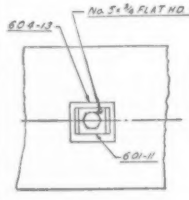
601-5 ROOT FITTING TIE PLATE - LOWER FRONT & REAR
MATERIAL .125-1025 STEEL - 2 REQ'D.

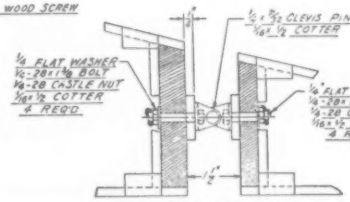


601-8 ROOT FITTING TIE PLATE - REAR UPPER
MATERIAL .125-1025 STEEL - ONE REQ'D.

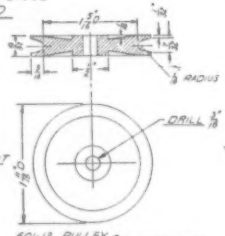


REAR ROOT FITTING ASSEMBLY



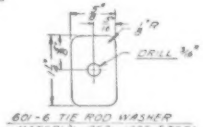


AILERON HINGE ASSEMBLY



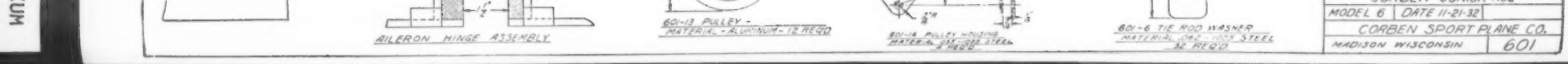
601-13 PULLEY -
MATERIAL - ALUMINUM - 12 REQ'D

601-14 PULLEY HOUSING
MATERIAL .032 STEEL
2 REQ'D.

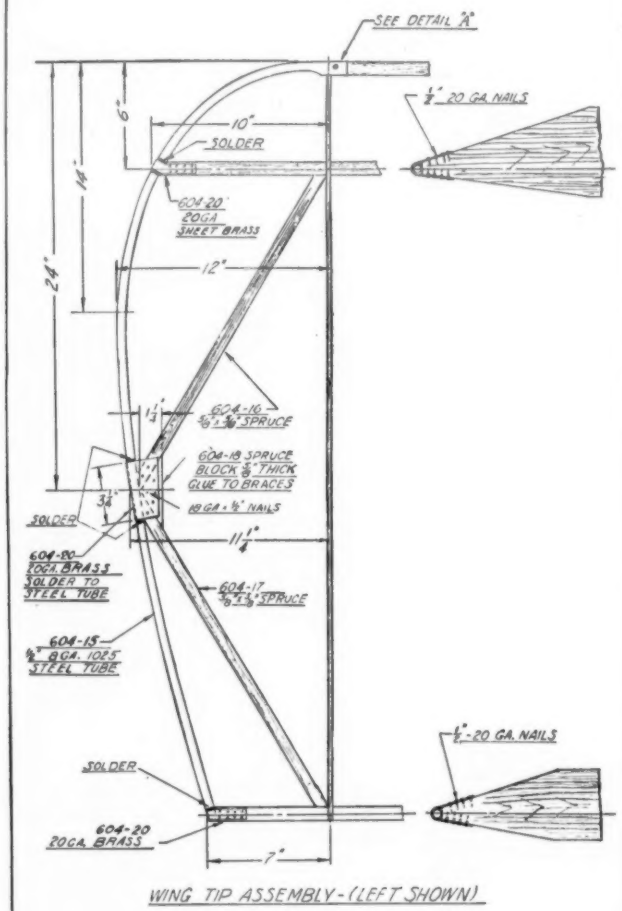


601-6 TIE ROD WASHER
MATERIAL .062 - 1025 STEEL
32 REQ'D.

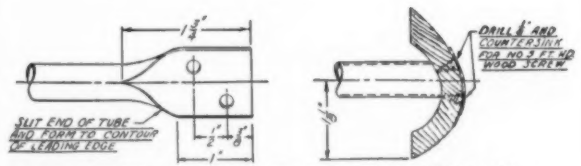
WING FITTINGS	
CORBEN JUNIOR ACE	
MODEL 6	DATE 11-21-32
CORBEN SPORT PLANE CO.	
MADISON WISCONSIN	601


AILERON HINGE ASSEMBLY
601-13 PULLEY - MATERIAL - ALUMINUM - 12 REQ'D
601-14 PULLEY HOUSING MATERIAL SAE-1025 STEEL 4 REQ'D
601-6 TIE ROD WASHER MATERIAL SAE-1025 STEEL 32 REQ'D

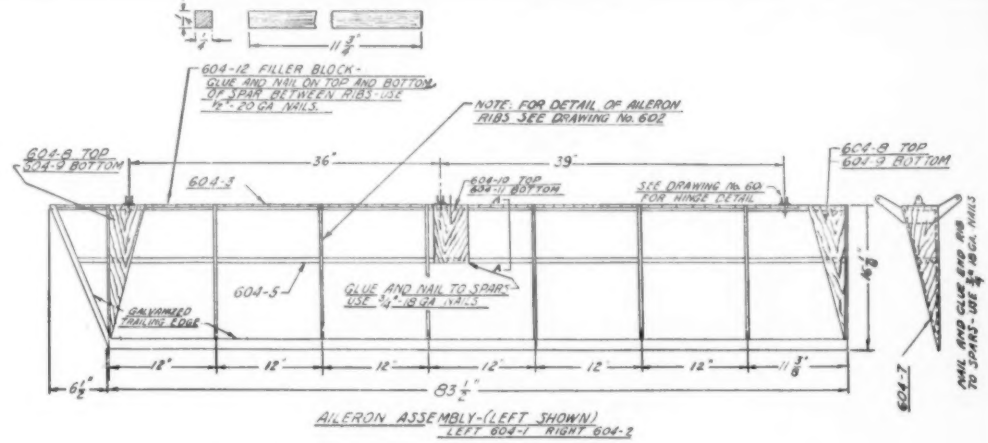
MODEL 6	DATE 11-21-32
CORBEN SPORT PLANE CO.	
MADISON WISCONSIN	601



WING TIP ASSEMBLY - (LEFT SHOWN)

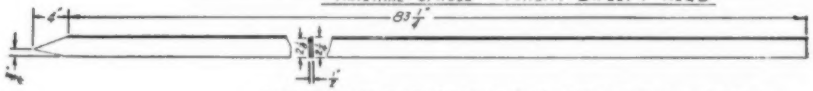


DETAIL A - ATTACHMENT OF WING TIP TO LEADING EDGE

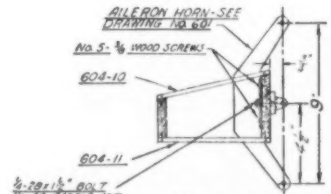

604-12 FILLER BLOCK - GLUE AND NAIL ON TOP AND BOTTOM OF SPAR BETWEEN RIBS - USE 1/2" - 20 GA. NAILS.
NOTE: FOR DETAIL OF AILERON RIBS SEE DRAWING No. 602
604-8 TOP 604-9 BOTTOM
36"
39"
604-3
604-10 TOP 604-11 BOTTOM
SEE DRAWING No. 601 FOR HINGE DETAIL
604-8 TOP 604-9 BOTTOM
604-5
GLUE AND NAIL TO SPARS USE 3/4" - 18 GA. NAILS
GALVANIZED TRAILING EDGE
12" 12" 12" 12" 12" 12" 11 3/8"
6 1/2"
83 1/2"
604-7
NAIL AND GLUE END RIB TO SPARS - USE 3/4" 18 GA. NAILS

AILERON ASSEMBLY - (LEFT SHOWN)
LEFT 604-1 RIGHT 604-2

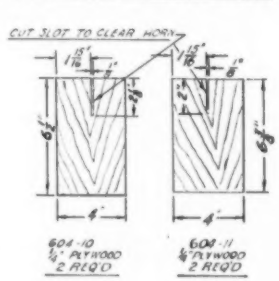
AILERON SPAR - REAR VIEW - (LEFT SHOWN) LEFT 604-3 RIGHT 604-4
MATERIAL - SPRUCE 1 RIGHT & 1 LEFT REQ'D



AILERON FALSE SPAR - (LEFT SHOWN) LEFT 604-5 RIGHT 604-6
- SPRUCE 1 RIGHT & 1 LEFT REQ'D

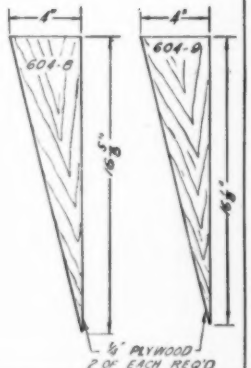


SECTION A-A
AILERON HORN ASSEMBLY

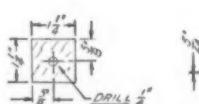


604-10 1/8" PLYWOOD 2 REQ'D

604-11 1/8" PLYWOOD 2 REQ'D



1/8" PLYWOOD 2 OF EACH REQ'D



604-13 1/4" PLYWOOD 10 REQ'D

604-7 AIL. END RIB 1/8" PLYWOOD 2 REQ'D

AILERON ASSEMBLY WING TIP ASSEMBLY	
CORBEN JUNIOR ACE	
MODEL 6	DATE 6-25-32
CORBEN SPORT PLANE CO.	
MADISON WISCONSIN	604

877

Corben

(*Continued from page 375*)

from standard sizes of No. 1025 aircraft flat wire so there will be very little cutting to be done.

After all of the fittings are finished they must be painted with some sort of rustproof paint or, better still, have them Cadmium plated. We have chosen headed tie rods for the internal bracing due to the fact that it has several advantages over bracing made of hard wire and turnbuckles. It eliminates making up loop-ends and at the same time the cost is reduced.

The next step takes us back to the wing. Carefully drill the tie rod blocks for the tie rods as shown. Note how the tie rods miss each other as they pass through the block and spars. After all of the tire rod blocks are drilled, slip the tie rods through the blocks, being sure that the special washers No. 601-6 are in place at each end of the tie rods.

The compression ribs and the tie-rods are the stressing members for pulling the rest of the wing into shape and we should go at this adjustment job carefully, taking plenty of time, so that the spars and edging will be parallel and so that all of the ribs will be square with the spars.

First, nail and glue all of the compression ribs into place and you will then be ready to true up the wing. The compression ribs should be square with the spars to begin with or else the job will be very difficult to carry out. With a large accurate square, line up the front bay at the root end of the wing by adjusting the two tie-rods at that end.

Make sure that the end rib at the root end of the wing is exactly square with the spars and when this is done, stretch a string along the front spar, extending from the root end to the tip. With this reference line before you, line up the remaining wing bays by adjusting the tie-rods in the same way. After this is done, better check back again to insure that the first bays have not been disturbed by the adjustments on the final bays.

After the wing is true, line-up, nail and glue the rest of the ribs in place, avoiding contact between the tie-rods and the ribs. In some cases it may be necessary to move the ribs a little so that they will not touch the tie-rods. If there is contact, then there will be rattles and vibration when the engine is running and this vibration may ultimately loosen up the wing. Be sure that all of the tie-rods are drawn up tight, then tape up the rods at the point where they cross each other so that they will not touch. Common tire or electrical tape can be used for this purpose.

With these parts in place, we next attach the leading edge as shown on Drawing No. 602 printed in the May

(*Concluded on page 394*)

A Homemade Glider Shock-Cord

by DICK COLE

SHOCK-CORD for launching gliders is a rather expensive item to the amateur flyer. Yet it is a very necessary accessory to the aerial sport. The plaited cover of ready-made shock-cord often becomes chafed, the rubber soon deteriorates and expensive replacement is necessary.

A very satisfactory shock-cord can be made from discarded tire tubes, as is shown in the sketch illustrating this article. About six inner tubes from large size balloon or truck tires are required. These can be picked up at a vulcanizing shop for a cent or two a pound. It is very essential that the rubber be "live."

Often, practically new tubes are discarded because they have too long a split or too many pin-holes to make it worth while vulcanizing them. These will serve as well as brand new tubes for making a shock-cord. "Live" rubber can be determined by making a little cut with the scissors and then trying to rip the rubber. Perished rubber rips very easily.

After the tubes have been obtained, the valve-stems are removed and each tube is cut completely around its inner circumference, that is, following the line made by the tire flap. The tube then appears as a wide endless, rubber band, nearly 18" wide. Now, with a pair of sharp scissors—a wire or saw-tooth cutting edge is best—start at the edge of the band and cut a ¾ inch strip around and around the tube. Patches and vulcanized spots must be avoided.

A wide sweep can be made around these weak points. A large balloon tube should yield about 150 feet of ¾ inch strip. The amount of rubber required to make up a suitable shock-cord is 18 strips, 45 feet long. Usually about six inner tubes will supply this amount satisfactorily.

The next items required are a 24 inch length of ½ inch rope thimble. The method of procedure depends upon whether the shock-cord will be used for manual or machine launching. The sketch shows how to proceed in either case that is chosen for launching.

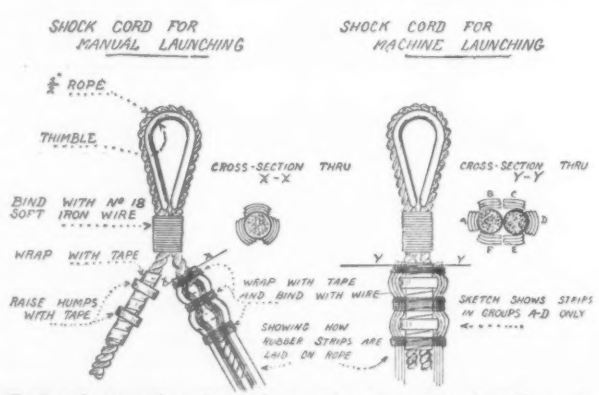
First, the rope is shaped around the thimble and bound at the throat with soft iron wire—about No. 18. It is well to use galvanized iron and solder over the windings. If this is done quickly, with a good hot iron, the solder will flow on without injuring the rope.

NUMBER OF RUBBER STRIPS IN EACH LENGTH OF SHOCK CORD — 9
TOTAL — 18
PLAIT LOOSELY BUT EVENLY
WHEN STARTING TO PLAIT, GROUPS A-B—C-D—E-F ARE GROUPED TOGETHER TO FORM STRANDS OF SIX STRIPS EACH
TOTAL NUMBER OF RUBBER STRIPS — 18

How the shock-cord is plaited and the method of laying the strands in place.

In the case of the manual launching shock-cord, the ends of the rope are left free and each is wrapped with friction tape. Then two humps about ½ inch high are made with the tape. The purpose of these is to give a more secure connection between the rubber strips and rope. Nine strips of rubber are now grouped around each end of the rope in groups of three layers each. The cross-sectional drawing brings this point out clearly.

The strips are now bound tightly into the grooves between the humps of tape, tape being used first and then covered with a wrapping of soft wire. This method makes a chafe-free joint between the rope and the rubber. The strands are then plaited as shown in the sketch. The best way to go at this is to tape the groups of strips together at intervals so they will not become tangled. The plaiting must be done loosely but evenly so that each strip receives the same strain.


SHOCK CORD FOR MANUAL LAUNCHING
SHOCK CORD FOR MACHINE LAUNCHING
ROPE
THIMBLE
BIND WITH No 18 SOFT IRON WIRE
WRAP WITH TAPE
RAISE HUMPS WITH TAPE
CROSS-SECTION THRU X-X
CROSS-SECTION THRU Y-Y
WRAP WITH TAPE AND BIND WITH WIRE
SHOWING HOW RUBBER STRIPS ARE LAID ON ROPE
SKETCH SHOWS STRIPS IN GROUPS A-D ONLY

Shock-cord connections for both manual and machine launching. A manual cord connection will not serve when power of any sort is used.

XUM

How Wing Ribs Are Tested

by VERNON W. PAYNE

Simplified instructions for making wing rib tests in accordance with the rules laid down by the Department of Commerce.

Showing the loading applied to the rib for a high angle of incidnce.

FOR years, the Army Engineering Department required airplane ribs tested by loading with sand or lead shot, to determine their strength.

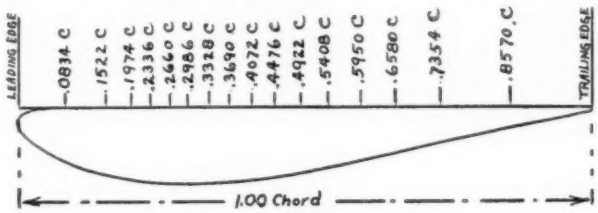
The government will not accept stress analysis alone, for the strength of the rib is quite often determined by how well the rib is attached to the spar. Therefore, the better the attachment to the spar, the greater the weight the rib is apt to hold. Therefore, don't build a strong rib and then expect a couple of nails to hold it to the spar.

We will show a few general types of ribs and then prove their strength by actually testing them. The Army Air Service requires ribs to be tested in at least two flight conditions, namely: high incidence and medium incidence, expecting that the designer has made it strong enough for low incidence and inverted flight conditions without requiring tests for these last two flight conditions.

The government has a lever system for testing ribs, putting the strain on the rib with a screw, but the amateur builder may have to use sand bags, as we do here. The loadings are placed on the ribs so that the Center of Pressure (C. P.) is at 28 per cent of the chord, from the leading edge of the rib (L. E.) for High Incidence (H. I.) test, and 42 per cent for medium incidence test. The medium incidence test puts the greatest strain on the center of the rib.

Fig. 1 shows how the weights are proportioned along the chord of the rib to approximate the same strain on the rib that would be present if the rib was part of the wing and giving lift to an airplane, with center of pressure at 28 per cent of the chord for H. I., and 42 per cent for medium incidence.

Fig. 2 shows where the ropes are tied around the ribs, to give the proper locations of the weights, for H. I. and M. I. The rib is supported in a framework like shown in Fig. 3 and the 16 ropes attached to the rib are made about three feet long with several knots in them to make it easy to attach the bags of sand.



MEDIUM INCIDENCE LOADING

Fig. 2. Showing location of test load application.

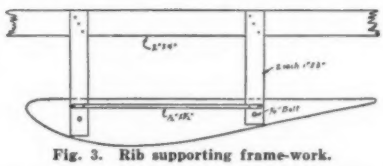
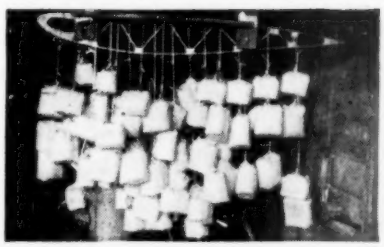


Fig. 3. Rib supporting frame-work.

Fig. 4 shows a typical rib ready for testing, with short spars fastened in their places in the rib. The testing rack holds the rib at the spars only, but it also has strips of wood alongside of the rib, not touching it, to prevent the rib from bending over sideways.

Suppose that we were building a monoplane with 30 ribs of 5 feet chord each, and each rib was one foot from the next one. If the wing had 150 sq. ft. area and the gross weight of the ship is 900 pounds, then we have a wing loading of 6 pounds per square foot of wing area. Each rib being 5 feet chord, is supporting 5 square feet of wing area times 6 pounds which is 30 pounds weight. Proof 30 ribs × 30 lbs. = 900 lbs.

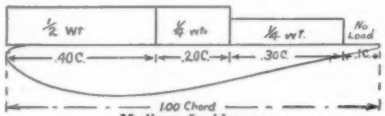


Showing the loading applied to the rib for a medium angle of incidence.

Most ribs will hold many times 30 pounds, but we must test it with a weight equal to the 30 pounds multiplied by a "load-factor," specified by the Department of Commerce. The load factor for ships of 2000 pounds or less, is 6.5. That means 30 lbs. × 6.5 or 195.0 pounds. This is the weight our rib must hold in the H. I. test. The Low Incidence (L. I.) load factor is 4.225; and the inverted flight (I. F.) load factor is 2.6.

Sometimes, ribs are made to stand greater loads than actually required, for they would be delicate to handle and easily broken under service conditions. For the medium incidence test on ribs, we add the high incidence and low incidence load factors and then divide by two which is 5.365 or 83 per cent of the H. I. test load factor.

The first test is a high incidence test. The chord of the rib is 60 inches and the first loading is 90 pounds or equal to a load factor of 3 times the initial load of 30 pounds. Each load following



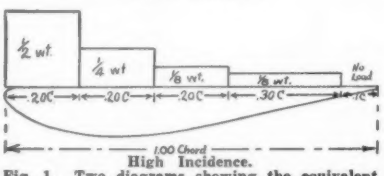


Fig. 1. Two diagrams showing the equivalent load distribution on the wings.

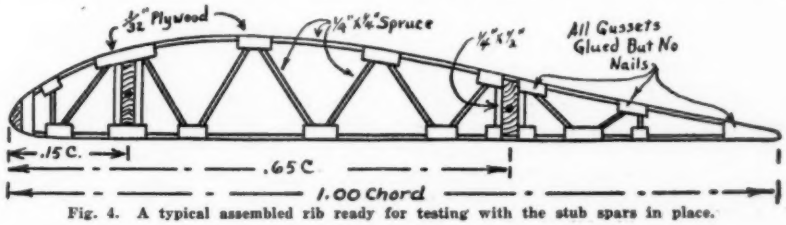


Fig. 4. A typical assembled rib ready for testing with the stub spars in place.

will be 60 pounds each, which is equal to a load factor of two. This is continued till the rib shows a sign of weakening and then the next loading is only 30 pounds or equal to one load factor. Continue till the rib breaks. After each loading, measure the deflection of the rib, that is a way of determining how much stiffer this rib may be than one of another type of construction. The results of each test is tabulated as in Table 1:

Being that there are 16 ropes on which 16 bags of sand, all of the same weight are to be hung, we must divide the first loading of 90 pounds by sixteen which is 5 pounds and 10 ounces, each. If the rib is a strong one, the second loading can be 60 pounds, that makes 16 bags of 3 pounds and 12 ounces each. The 30 pounds loading is 16 bags of one pound and 14 ounces each.

Some designers like to incline the stick about 15° when testing for H. I., and this puts a strain on the rib which is somewhat like *lift* and *drag* at the same time.

Sometimes it is desirable to know that the article being tested is strong enough, but we do not wish to break it. If we design it to hold 125 per cent of the required load, then if under a loading test it holds 60 per cent without showing signs of fracture or permanent set, it is acceptable. For example:

If a rib is to hold 195 pounds in the H. I. test, which is figuring a load factor of 6.5, we would desire the rib to hold 25 per cent more weight without breaking. That load would be 195 pounds plus 49 pounds or a total of 244 pounds.

If we load the rib to 60 per cent of 244 which is 146.4 pounds and the rib holds it with no sign of fracture, it is O.K., and need not be carried to destruction. Then give it the medium incidence test and if it holds the 60 per cent of the desired loading, you may assume it would hold the entire amount without breaking.

In the "Remarks" of Table 1, you will see that the description of the way the rib was made tells us that no nails were used to hold the gussetts in place while the glue set. Clamps were used and they put an even pressure on the whole surface of the gussett, making a better glue joint than nails would do. Nails only take the place of the clamps while the glue dries. Nails make holes and crack the spruce strips of the rib, thereby weakening the rib.

In the H. I. test, we did not carry the test to destruction for we wanted to save the rib for the M. I. test which is much more severe on the mid-portion of the rib. In the Remarks of Table 1, you will note that the required load of 195 pounds x 125 per cent=244 pounds. This test shows that the rib held 360 pounds without a fracture. This proves the rib more than safe, for it would have probably held over 500 pounds.

In the M. I. test, results of which are shown in Table 2, we note that the rib failed under a load of 420 pounds. The reason for failure was the cap strip could not stand the large bending moment and broke. The rest of the rib held, as the picture shows. In the Remarks of Table 2, we note that the required load is 202 pounds so the test of 420 pounds is more than satisfactory.

However, from this test, we learn that the chord member, or cap strip, could have been larger in cross-section, say ¼ x ½ inch and it would come nearer being as strong as the rest of the rib. The gussetts could have been larger also, that is, in the mid-portion of the rib.

TABLE 1. H. I. TEST — LOAD FACTOR=6.5

No. of Loading	Weight Per Loading	Deflection of Rib	Remarks
1	90 lbs.	1/32 inch	*Chord*=60".
2	90 lbs.	1/64 inch	*Type: Warren Truss.*
3	60 lbs.	1/64 inch	*Construction: Built-up of ¼" x ¼" Spruce Strips, 1/32" plywood gussetts, gussetts glued, not nailed.*
4	60 lbs.	0 inch	*Load Required*=30 *lbs.* x 6.5=195 *lbs.*
5	60 lbs.	1/64 inch	195 *lbs.* x 125%=244 *lbs.*
6	360 lbs.		*This was not carried to destruction.*
7			
8			
9			
10			

TABLE 2. M. I. TEST — LOAD FACTOR=5.365

No. of Loading	Weight Per Loading	Deflection of Rib	Remarks
1	90 lbs.	1/32 inch	*Chord*=60".
2	90 lbs.	1/64 inch	*Same Type of Rib used in H. I. test.*
3	60 lbs.	1/64 inch	
4	60 lbs.	0 inch	
5	60 lbs.	1/32 inch	*Cap Strip Broke.*
6	60 lbs.		*Load Required*=30 *lbs.* x 5.37=162 *lbs.*
7	420 lbs.		162 x 125%=202 *lbs.*
8			
9			
10			

The Norrbom Diesel

Detail of cylinder showing air-scoop.

EXPERIMENTATION with the Diesel engine principle is not dead by any means though this type of engine has not yet been adopted for practical service to any extent.

One of the latest inventors and experimenters in the Diesel field is E. Norrbom, West Los Angeles, Calif., a mechanic at the Douglas Aircraft plant.

To begin with, this is a two-stroke cycle engine with no gears nor charging pumps. The air is introduced under pressure through funnels in the intake passages which receive the air from the propeller blast. The internal cooling of the pistons is another feature that overcomes the piston heating that has introduced so many difficulties with other engines.

The engine operates on cheap fuel oil, such as kerosene or furnace oil, taking the place of the more expensive gasoline employed with present engines. As the photograph indicates, the functioning of the engine is controlled both by piston controlled ports on the cylinder walls and by valves in the heads of the cylinders.

The experimental engine shown in the photos is a four cylinder radial engine, developing 150 h.p. at 1,400 r.p.m. It swings a prop designed for a 180 h.p. Hisso engine. For greater power, the number of cylinders and their size can be increased to any ordinary amount.

The Norrbom-Diesel installed in plane.

XUM

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

Help! Help!

FOR the past few months we have been running along nicely with the pictures coming in, but now we are short of material once more. There is just about enough on hand to complete the next issue.

So, we ask you fellows to kick in with some more pictures of that ship you are building, together with a good description of it. An ordinary snap-shot will do if you have nothing better, but it should be a good clear snap-shot with no buildings or bushes in the background. As you have probably noticed, buildings and trees detract from the picture and make it difficult to study the plane.

There are a whole lot of you fellows that have intended doing this very thing but haven't got around to it. So now please make a special effort so that our other readers can see what you have been up to.

Lightplane Operation

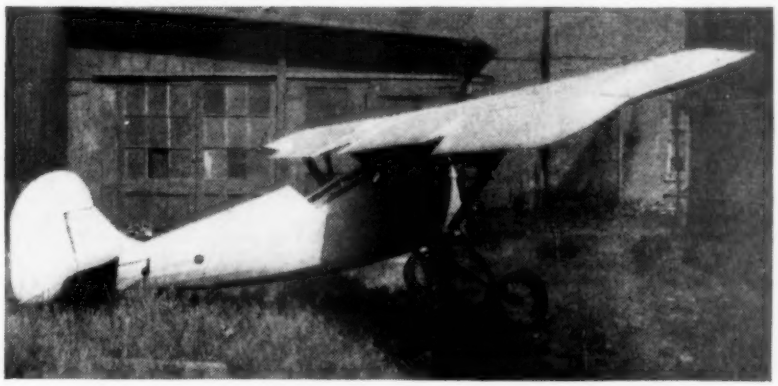
COMPARATIVE figures between the operating cost of a lightplane and a light automobile show that each vehicle has its special field of application.

Records indicate that many lightplanes will show at least 20 miles per gallon of gasoline at a speed of about 80 m. p. h. while with a very light plane, in the powered glider class, this mileage may run up to 30 or 35 miles per gallon. Under such conditions, the cost of fuel will run less per mile, even with a premium placed on aviation gasoline, when we consider that the average light car under ordinary road conditions will not do much better than 16 to 18 miles per gallon, and usually less than this in dense traffic.

On the other hand, the lightplane is more expensive of the two when operated by the hour, because in that hour, the lightplane runs up a very much greater mileage. It will average twice the distance in the air that can possibly be attained by an automobile running on the road, for it is not always possible to maintain an average of 40 m. p. h. on a traffic road. Traffic congestion, stop signs and stop lights prohibit very high average road speeds except in the open country distant from large cities.

In short, the lightplane is the cheapest vehicle when we wish to travel between two definite points, but is the most expensive means of travel when we are out aimlessly joy-riding by the hour. The plane is most expensive when we take it out to idle away a week-end afternoon.

Committeeman Fiedeldy Shows His Ship



Mr. Fiedeldy's monoplane looks capable and clean-cut.

THIS fine little ship was designed and built in New Jersey, by Mr. Fiedeldy, who, as you probably know, is on the committee of our lightplane association.

It is a high wing monoplane of the type generally known as a "parasol," except that the wing is set so low in this case that it has almost ceased being a parasol and verges on the high wing type. At the time that this picture was taken, the power-plant had not been installed.

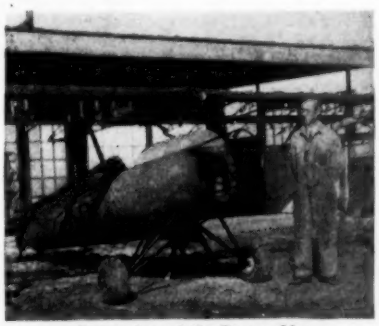
One thing that appeals to us is the clean cut lines and simplicity of the buggy. We will accept his promise of giving us a detailed account of its performance.

V. W. Payne's Monocoque Plane

Side elevation of Mr. Payne's Lightplane.

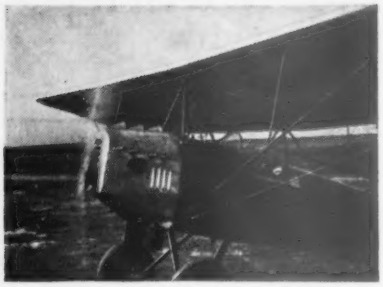
VERNON W. PAYNE, LaGrange, Ill., is a frequent contributer to POPULAR AVIATION and is also a member of our Lightplane Association committee. He sends us these pictures of his monocoque lightplane which were taken during the construction period.

In our next issue, Mr. Payne will give you a whole lot of dope on this ship, how it was designed and other details of a very interesting nature. Mr. Payne is an experienced airplane designer and certainly knows his stuff when it comes to doping out lightplanes.



Front view of the Payne ship.

They Build the "Bug"



This is the nose of the "Bug."

J. E. KENNEDY and Claude Beamgard, Clover, S. C., have built a fine little lightplane which they have christened, "The Bug." It is powered with a Ford "A" engine which swings a 6'-6" propeller and has shown remarkable performance.

It weighs about 700 pounds, ready to fly, takes off quickly and climbs rapidly. Its high speed, while rated at 75 m. p. h., was high enough to enable it to fly side-by-side with a Ford tri-motor for 12 miles which rather demonstrates that its actual top speed is considerably higher than its nominal rating.

The owners taught themselves to fly on this ship, starting with short straight hops and now they fly anywhere they wish with perfect confidence.

This is the way the "Bug" looks when ready for flight.

Ensly Makes a Good Record

H. Y. ENSLY, Livingston, Calif., is the builder of a plane that has flown 141 hours without the slightest kind of an accident and has had only one forced landing due to a plugged gas line. The ship is unlicensed so we hope that this remarkable record of an unlicensed ship will sink home to some of our state meddlers who assume that every homebuilt crate means just one more crash.

Mr. Ensly and his Pal with their ship.

Wing-Slots and Flaps

WITH one exception, there have been no experiments in this country with wing-slots and flaps on lightplanes, although the advantage of such devices are very apparent.

When we sit down and consider the matter, the wing-slot-flap combination means more to the lightplane than to any other type. In the first place, wing-slot-flaps make a very low landing speed possible combined with a high top speed, and this is important in the average converted cow-pasture used by the amateur as an airport.

Second, it makes it possible to climb the ship up and out of a small landing field without danger of stalling which should also appeal to the amateur. By the proper arrangement of flaps and slots, it is possible to take off at an angle in excess of 45 degrees, thus making it a simple matter to clear the trees that usually surround the smaller private fields. We hope to hear from some experimenter who is working along these lines and trust that we will get the necessary dope to hand on to the rest of the gang.

Takeoff and Landing Speeds

WHILE few amateur fields have them, barometers will explain variations in the landing and takeoff speeds that frequently occur during the season. The barometer, which is a comparatively inexpensive instrument, measures air density and air pressure, the primary basis of wing lift.

For example, on a very hot day, the air is less dense than on a cool day and therefore the takeoff and landing speeds will be higher. Very often, this difficulty is charged up against the plane or the engine.

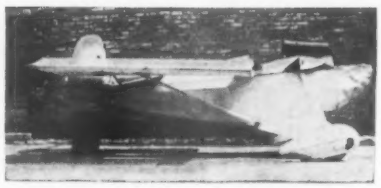
Again, just before a heavy storm, the barometer will indicate "low" atmospheric pressure and low density, which explains the excessive running necessary for a takeoff under such conditions. In short, this is the very difficulty experienced at fields located at high altitudes where the rare atmosphere in the mountainous regions makes landings and takeoffs difficult.

Notes on Gasoline

AVIATION gasoline is a mixture of various fluids which have different boiling points, hence some of these fluids evaporate more rapidly than others. Aviation gasoline contains a larger percentage of highly volatile or low boiling point fluids than automobile gasolines, hence it loses a greater percentage of its valuable components more rapidly than auto gas when held in storage during hot weather.

It is not advisable, therefore, to store aviation gasoline for any length of time because many of the lighter "fractions" will pass off by vaporization, leaving only the heavy kerosene ends that make starting difficult and which may produce detonations.

Here's a Folding Wing Job by Scott



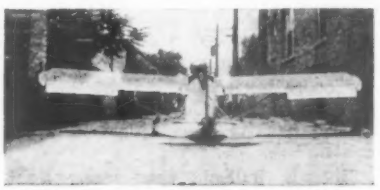
The Scott ship with wings folded.

THIS is a Chicago folding wing plane that looks very good, and if we are invited, we're going over to take a look at it. It was built by James W. (Scotty) Scott, 5849 S. Wabash Ave., Chicago, Ill.

Scotty sent the two snap-shots of the buggy, and here are the vital statistics relating to the job.

Span	20 ft., 6 in.
Length	14 ft., 0 in.
Size folded	8 ft. x 14 ft. x 10 ft.
Height	14 ft., 10 in.
Engine	Harley Twin
Power	20 h.p.

He says that his next job will be an all-metal low-wing monoplane, and he wants some of the gang to write to him concerning their activities.



The wings of the Scott extended.

Soaring Society Meet

THIS year, The Soaring Society of America will again stage the annual national soaring meet at Elmira, N. Y. It will be held from July 10 to July 23, inclusive.

In addition, the Society will provide a national soaring camp for all branches of the sport. This camp will be opened one month prior to the contest and it is expected that the camp will go a long way toward the development of the sport in this country as it now exists in Germany.

The Soaring Society is under the leadership of Warren E. Eaton, one of this country's leading soaring pilots.

The soaring camp, which will be in operation from June 12 to July 9, will be operated just as strictly as the contest itself to insure safety and effectiveness of instruction. Special arrangements have been made with the Haller School of Soaring Flight, Pittsburgh, who will provide the instruction. The complete course including the soaring license, check and 15 minutes soaring will cost only $75.00.

Entries for the contest should be addressed to Warren E. Eaton, Norwich, N. Y., who will supply the necessary forms and information.

XUM

How to Build the Curtiss "Swift"

by

JOSEPH S. OTT

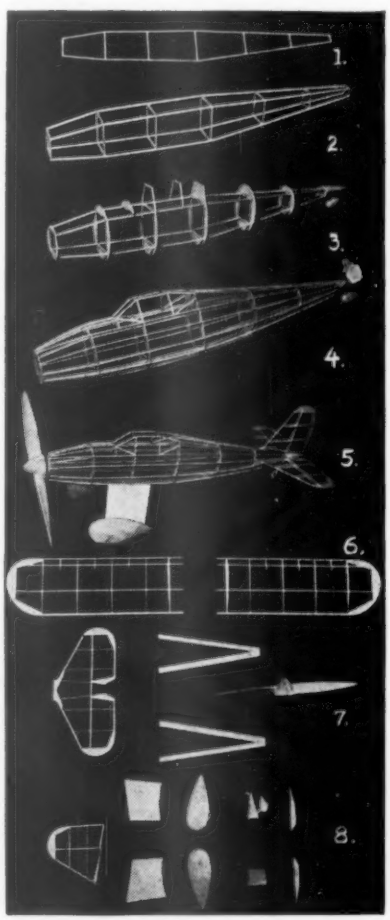
Model Editor

POPULAR AVIATION

The completed model of the Curtiss "Swift," also known as the "XP-934," is one of the most realistic of scale flying models.

THE "Swift" is the latest development of the Curtiss-Wright Corporation and adapts itself ideally to model construction. As the motor in the large plane is entirely enclosed in the fuselage and of a liquid-cooled type, the weight which would necessarily be required by the parts for a radial motor are entirely eliminated.

The body of this model is a perfect spindle streamline from the pointed nose to the pointed tail. When constructing this model utmost care should be employed and the parts should be made very light so that good flying quality may be obtained. It would be advisable to employ a dihedral angle a little larger than that shown as a low wing airplane model is a little more difficult to balance laterally than a high wing model.



Progressive stages in building the framework of the Curtiss "Swift."

CONSTRUCTING THE BODY

It is best to make a full size layout of the side view of the body, only, so that the longerons may be bent and assembled as in Photograph No. 1. The illustration in this photograph shows the simplicity of one body side. Two of these, exactly alike, are required. Longeron material 1/8 inch square.

BODY CONSTRUCTION—STEP NO. 2

Photograph No. 2 shows the two body sides assembled into a square shaped longitudinal form. The pieces used across the top and the lower part of the body are cut to the same length. To obtain the correct length for these parts it will be necessary to make a full size drawing of the top view as illustrated. Enlarging the drawing is simple enough if one uses a divider and doubles the small drawing throughout.

BODY CONSTRUCTION—STEP NO. 3

The third photograph in the body construction series shows the tail plug and the body formers cemented in position. These formers are drawn to full scale and can be traced directly from the magazine on the wood or may be traced on thin paper and then transferred to wood.

Before assembling the body formers, make certain that there is a little more material remaining on these parts than is actually required so that after it has been assembled and has dried, it can be sanded down to fit the curve of the body. By allowing a small amount of additional materials on the formers the finished job is much neater than if one were required to cement additional parts to them.

BODY CONSTRUCTION—STEP NO. 4

Photograph No. 4 shows the body with the longitudinal fairing strips cemented in place. Two are required on each side, three strips on the bottom and five on the top. The sizes of these parts are 1/32 x 1/16 inch and should be sanded smoothly before assembling in position. In this photograph you will also notice the construction of the windshield or cockpit which is entirely covered with transparent material. Thin cellophane if cemented in place and when thoroughly dried can be heated slightly, causing it to contract thereby eliminating any wrinkles.

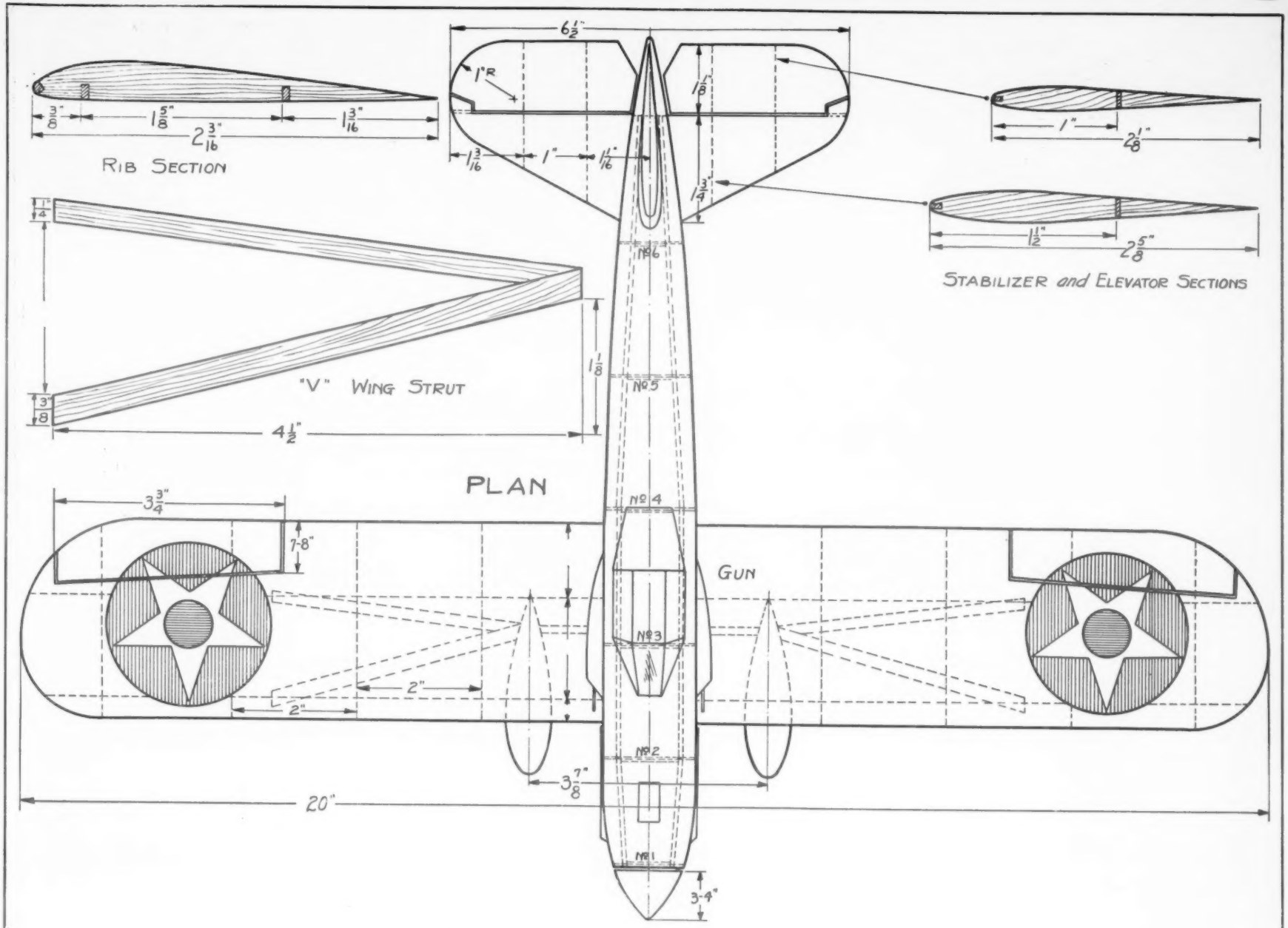
BODY CONSTRUCTION—STEP NO. 5

Here we illustrate the model with the propeller, the landing gear, the rudder and the stabilizer, all in place. The propeller is removable from the front end and the bearing is a small flat plug which sets into a circular disc cemented into the square framework of the body. This disc has a hole directly in the center having a diameter equal to that of the bearing.

The landing gear strut may be a solid piece of light balsa approximately 1/8 inch thick, but for best results it is recommended that four large holes be cut into this strut and covered with tissue paper. In this way some of the weight will be eliminated. The wheels are held in place by small axles which pierce both sides of the pants.

A cross-brace between the pants is illustrated in the front view of the drawing and the location of this part is just a trifle forward from the rear part of the trailing edge of the landing gear strut. It is, however, located on

(*Continued on page* 386)


RIB SECTION
PLAN
"V" WING STRUT
STABILIZER and ELEVATOR SECTIONS
GUN
No 6
No 5
No 4
No 3
No 2
No 1
20"
4½"
3-4"

FIN and RUDDER SECTIONS

WINDSHIELD COVERS ENTIRE COCKPIT

$2\frac{1}{16}$" $\frac{13}{16}$" $2\frac{9}{16}$" $\frac{13}{16}$" $2\frac{1}{16}$" $\frac{13}{16}$" $1\frac{1}{8}$" $\frac{7}{8}$" $2\frac{3}{4}$" RED BLUE

$5\frac{1}{4}$"

№1 №2 №3 №4 №5 №6

$1\frac{5}{8}$" $1\frac{7}{8}$" $2\frac{1}{4}$" $2\frac{3}{16}$" $2\frac{3}{16}$" $2\frac{1}{8}$" $1\frac{5}{16}$" $13\frac{9}{16}$"

$1\frac{1}{8}$"

SIDE VIEW

$\frac{1}{4}$" 2" $\frac{3}{4}$" $\frac{1}{2}$"

PANT COVER 4 each.

$\frac{3}{8}$" 3" $1\frac{1}{16}$" $\frac{5}{8}$" R.

CENTER of PANT 2 each.

4" $1\frac{7}{8}$" 3-4" DIHEDRAL $2\frac{1}{2}$"

FRONT VIEW

"SWIFT" CURTISS PURSUIT

POPULAR AVIATION - JUNE 1933

Curtiss "Swift"

(*Continued from page* 383)

the centerline of the pants. The tail parts have been cemented in position on this photograph but should be removed for covering and later cemented back in place permanently.

WINGS—STEP NO. 6

A left and a right wing, both alike in construction, should be assembled to the proper dimensions and the following materials will be required: The ribs are 1/32 inch thick; the leading edge 3/32 square; the spars are 1/16 x 1/8 inch; the trailing edge is also 1/16 x 1/8 inch. The wing tips are 1/16 inch thick and the material for these should be of the lightest balsa obtainable.

Three small, short nose ribs are added between the ribs as illustrated. These help to maintain the shape and curve of the top side of the wing. Please note that the rib closest to the body is set at an angle which should conform to the curve of the body at the point where it attaches. The spars, leading edges and trailing edges extend beyond the first rib and these parts are used to cement the wing to the longerons.

TAIL—STEP NO. 7

The rudder and stabilizer are constructed of the same size materials as used in the wing. However, the spar is ¼ inch deep. It is not necessary to leave quite as much material in the wing tips as shown in the photographs. The stabilizer is shown in one piece, but it may be necessary to cut it in two so that the two center ribs will fit snugly against the body on each side. The rudder is constructed similar to either half of the stabilizer.

LIST OF MATERIALS

Longerons	1/16 x 1/16 x 18"	6
Spars	1/16 x 1/8 x 18"	2
Trail. Edge	1/16 x 1/8 x 18"	2
Entering Edge	3/32 x 3/32 x 18"	2
Propeller	7 inch diameter	1
Pants—Outside	1/16" thick	4
Pants—Inside	3/8" thick	2
Struts L. G.	1/8" thick	2
Struts—Wing	1/8" thick	4
Ribs, etc.	1/32" thick sheet	1
Axles	.024" diameter	2
Bearing	Turned	1
Shaft	.024" diameter	1
Washers	1/8" diameter	3
Rubber	1/32 x 1/8"	1
Wheels	1" diameter	2
Wheel	3/8" diameter	1
Cement	Clear	1
Banana Liquid	Clear	1
Tissue	Red	1
Tissue	Yellow	1
Tissue	1/16" black stripes	2
Windshield	Thin cellophane	1
Nose Spinner	1¼" diameter	1

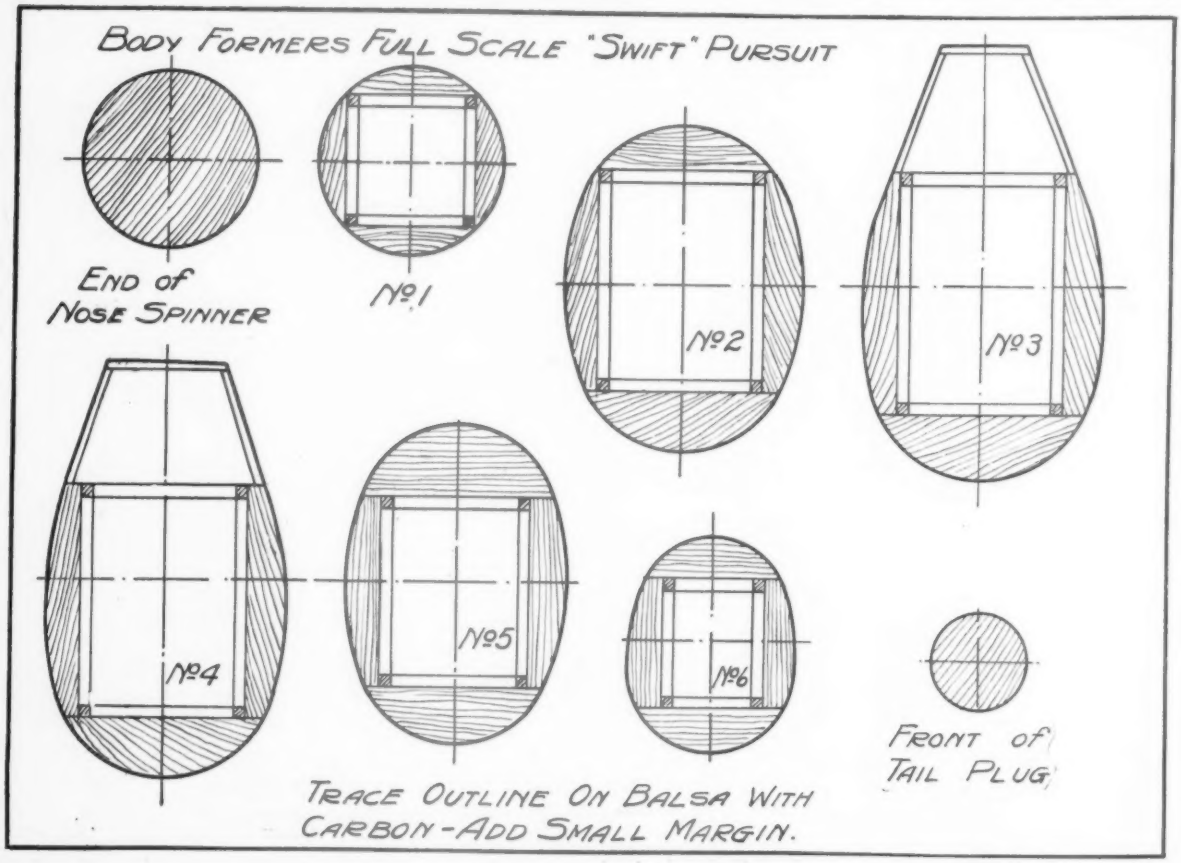
WING STRUTS—STEP NO. 8

The wing struts are made of ⅛ x ⅜ inch balsa for the front piece and ⅛ x ¼ inch for the rear piece. These parts should be streamlined before they are cemented into the "V" form. Allow approximately ½ inch additional length to these struts so that they may be fitted properly after the wings have been cemented to the body. The wing struts rest on the pants just opposite the point where the cross brace between the inside of the struts is attached.

LANDING GEAR—STEP NO. 9

The wheel pants are each constructed in three pieces. The center piece is cut out to the general shape having a thickness of ⅜ inch and then the sides are cemented in place. The complete pant is allowed to dry and then sanded down to conform to the shape as illustrated on the Front and Side Views of

(*Concluded on page* 394)



Build This Model Rotor Ship

by LAWRENCE CLOUSING

This prize winning rotor ship will sure give our model builders a thrill when she takes off. Try your hand at this interesting job.

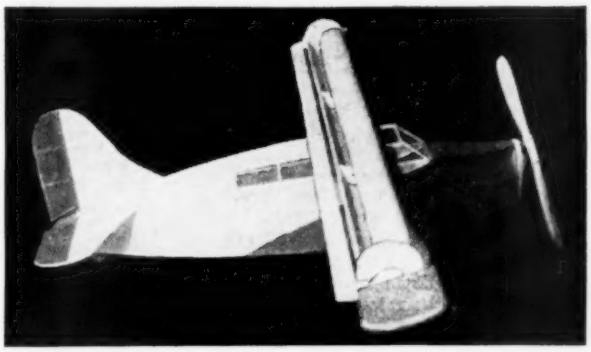
BILL OF MATERIALS

Rotor:		
Vanes of rotor	1/32 x 1¼ x 16" Balsa	2 pieces
End pieces	3/64 x 1¼" dia. Balsa	2 pieces
Semi-circular supports	1/32 x ¾" dia. circle—Balsa	8 pieces
Rotor support:		
Main supporting spar	⅛ x ⅜ x 16½" Hard Balsa	1 piece
End pieces of support	1/16 x ¼ x 1" Balsa	2 pieces
Wing tips	1/16 x 1/16 x 12" Balsa	2 pieces
Wing tips	1/16 x ⅜ x 1½" Balsa	2 pieces
Fuselage or body:		
Longerons	1/16 x 1/16 x 11" Balsa	2 pieces
Longerons	1/16 x 1/16 x 6½" Balsa	2 pieces
Body formers	1/16 x 2 x 12" Balsa	1 piece
Nose block	⅜ x 1 x 1¾" Balsa	1 piece
Tail plug	⅜ x ¾ x 1" Balsa	1 piece
Sheet under rotor	1/64 x 1⅝ x 2" Balsa	1 piece
Nose plate	1/16 x 1 x 1¾" Balsa	1 piece
Blocks to which landing gear glues	1/16 x ⅜ x 1¼"	2 pieces
Landing gear:		
Pieces out from fuselage	5/16 x ¾ x ⅞" Balsa	2 pieces
Main strut	1/16 x 5/16 x 1½" Balsa	2 pieces
Brace struts	1/16 x ⅛ x 2½" Balsa	4 pieces
Tail surfaces:		
Rudder	1/32 x 1/32 x 5" Bamboo	1 piece
Tips of horizontal stabilizer	1/16 x ½ x 1½" Balsa	1 piece
Ribs, leading and trailing edge, and braces	1/16 x 1/16 x 12" Balsa	3 strips

Miscellaneous parts:

Wheels—celluloid 1 in. dia.
1 sheet very fine bamboo tissue
1 sheet Hakone red tissue paper
1 tube cement
Banana oil
Propeller—6½" dia. x ¾ x ½
Rubber motor—4 feet of ⅛ x 1/32 rubber
.020 piano wire—8"
Cellophane for windows
Washers—3—⅛" dia. and 1—¼" dia.
Beads—6

Detail drawings of the Hatlestad "S" rotor model which is easily assembled. No wings are required, the lift being performed by the "S" shaped rotor.



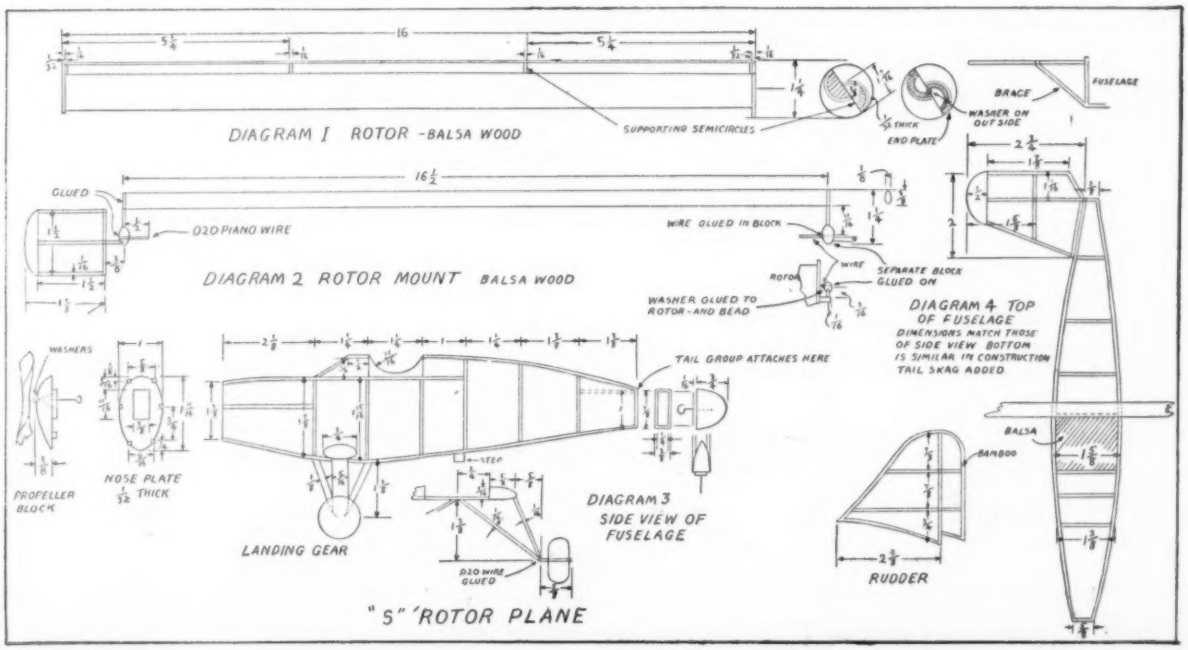
HERE is the latest for model builders. It is a model demonstrating an entirely new method of flight and it really flies.

Entered in an originality contest held at the University of Minnesota in March it readily took first prize. Steps to protect patent rights have been taken, and the National Advisory Committee of Aeronautics, Washington, D. C., has been told of the discovery. The inventor of the rotor plane is Harold Hatlestad, a 15 year old boy.

The Hatlestad model has a conventional propeller, but in place of wings there is a freely spinning horizontal rotor 16 inches long and about 1¼ inch in diameter. The rotor is composed of two semicircular vanes on an axis—in cross section shaped like the letter "S". As the plane moves forward, air pressure causes the rotor to revolve backward.

That action, combined with the forward movement, reduces the pressure on top of the rotor and increases the pressure on the bottom. If the motor should quit, the rotor continues to spin in descent, stretching out the ship's course into a long glide.

Hatlestad's scheme is not to be confused with the Flettner rotor or the recently publicized paddle wing rotor planes, both of which involve power



driven rotors. His scheme employs the Savonius windmill principles and the idea came to him from the observation of rotor kites.

It was back in 1925 that a Finnish scientist, Dr. F. J. Savonius, became interested in this type of rotor for use as a windmill. He sought to improve on the Flettner rotor ship by devising a rotor that would turn of its own accord in the wind. The "S" rotor was the result.

On fitting up a small sloop with "S" rotors, he found that in a fair wind his boat could do about six m.p.h.

For a full sized airplane, the practicability of the idea is yet to be seen. For the model airplane builder, however, an actual flying model of this latest type of airplane can be made by following the directions given here.

Flying the model involves little more skill than in the launching of other model airplanes. Before launching a quick up and down movement of the model will set the rotor spinning. Then, releasing the propeller, the ship is off on its glide. Some difficulty may be experienced in obtaining the proper balance of the airplane in flight. Any fore and aft unbalance however, can be corrected by change of stabilizer setting, an addition of weight fore or aft, or by shifting the position of the rotor slightly.

Lateral unbalance, (dropping of one wing) can be corrected by bending up the tip end of the rotor on the side of the low wing. A change in the angle of the rudder also affects this lateral stability.

It will be found that unless special efforts are taken to make the rotor straight and in perfect balance, the rotor will vibrate in flight and will not turn over as rapidly as it should. If it vibrates too much, it will hit the structure causing it to stop and the ship will immediately lose its lift. The bearings on which it is mounted should be as frictionless as possible, and the rotor should be separated from the end mount by a washer on the rotor and a bead near the mount.

BUILDING THE ROTOR

Place the two long strips of balsa for the rotor in warm water. Take them out and bend with the length of the strips running down a ¾ inch pipe. This forms the curve desired.

Wrap the strip with a strip of cloth to hold the balsa wood in shape till it dries. Caution must be taken in this operation to be sure that the strips run straight down the length of the pipe. If they do not, the strip will have a curve to it which will prevent its proper rotation as a rotor. Also the two pieces must be of the same width so that they will be of equal weight. It is well to cut them from the same sheet.

Immediately after taking the strips off the pipe, the four semi-circular formers must be glued to the inside of each rotor blade to prevent warping and to hold the rotor in shape.

Mount the rotor on the end pieces by glueing, taking care to get the two blades equally spaced with respect to the center of the end pieces. It is here that the greatest difficulty in the construction of this model is experienced. The rotor, when completed, must be in perfect balance to prevent vibration and to permit its free rotation by the action of wind.

THE FUSELAGE

The fuselage is very simple. Make a full sized drawing of the side of the body. Lay the members on it and glue them together. Make the two side halves in this way. With the two sides completed start working from the tail forward, placing the body formers between the two sides. The members which are then left sticking out at the nose are glued to the nose plate.

In case the longerons at the nose do not bend well, soak them in hot water before mounting, so that they will assume a good curve. As construction proceeds, sight along the body to see that the members are square.

TAIL-GROUP

This is simply made, the pieces being laid out on a full size sketch and glued together. The shape and structure is clearly shown in the drawing. The tail-surfaces are mounted on the fuselage by glueing after they and the fuselage have been covered with tissue.

LANDING GEAR

The pieces extending out from the fuselage are glued to blocks in the fuselage structure. The main strut is glued to the block and the bracing struts are then glued on. The wire axle is mounted by bending up the portion beyond the ½ inch allowed for the axle. The bent portion has a small loop. The wire is glued to the strut, the wire being thus held quite securely.

A bead is placed between the wheel and the strut to prevent rubbing. A bead is glued at the end of each strut to hold the wheel on.

PROPELLER

A standard form of propeller can be used, but care must be taken to see that it clears the nose block well. The ¼ inch washer is mounted in the nose block and the ⅛ inch washer is used for bearing.

ROTOR MOUNTING

The spar for mounting the rotor is glued to the top of the fuselage. While the end pieces are being glued in place, the rotor is slipped in between them on the wire axles that protrude about ½ inch from the end pieces. Care must be taken to see that the rotor clears the body in all positions by at least ⅛ inch.

The rotor must also be supported while the end pieces are drying to prevent their position from being altered. A bead with a washer on the rotor side separates the rotor end from the mount. The wire axle is glued in a hole in the end mount, and is bent around with another piece glued over it, thus being held securely in place, so as to be able to withstand the vibrations of the rotating rotor.

POPULAR AVIATION at World's Fair

WHEN you visit the Century of Progress Exhibition this summer at Chicago, you will find that the POPULAR AVIATION booth is one of the features of the model display in the Air Show building.

In this building you will find the world's greatest model airplane exhibit, models of all kinds and model kits and parts by all of the model manufacturers.

And in the center of this general model exhibition will be the P. A. trophies and the model planes that won the honors in the recent contest held by POPULAR AVIATION. It will be well worth your while to spend a great deal of time in this part of the World's Fair.

The model exhibit at the World's Fair will be in charge of Messrs. Lasher and Kreutzig. POPULAR AVIATION is lending its full cooperation to make this model exhibit an international success.

Here is the list of manufacturers who have already arranged to exhibit at the Fair. A complete list of exhibitors will appear in the next issue.

Acme Model Service, Chicago; Airway Model Supply Products, Detroit; Cardinal Aero Model Supply Co., Detroit; Cleveland Model Airplane & Supply Co., Cleveland; Comet Model Airplane & Supply Co., Chicago; Gil Manufacturing Co., Chicago; Hawk Model Aeroplane Co., Chicago; Highway Model Aircraft, Brooklyn, N. Y.; Lennon Model Aero Club, Providence, R. I.; Midwest Model Airplanes & Supplies, Omaha, Nebr.; Miniature Aircraft Corp., New Brighton, N. Y.; National Model Aircraft Co., New Rochelle, N. Y.; Scientific Model Airplane Co., Newark, N. J.; Victor Stanzel, Schulenburg, Texas; U. S. Model Aircraft Co., Brooklyn, N. Y.; Wisconsin Model Aircraft & Supply Co., Milwaukee, Wis.

Curtiss Hawk P-6E Replica

A BEAUTIFUL replica of the Curtiss Hawk P-6E, rich in detail, has been produced by Victor Stanzel, Schulenburg, Texas. It is a highly ornamental decoration, containing such features as a dummy instrument board, honeycomb radiator, non-skid wing walks, streamline struts and all of the other details on the large ship.

Curtiss Hawk P-6E Replica.

◆ BARTER AND EXCHANGE ◆

Good Opportunities for Our Swappers

This service is free to all of our readers, but the publishers reserve the right to reject any or all notices that are not in accord with the policy of this magazine. Only trades or "swaps" will be permitted. For cash deals, buying or selling, refer to our Buyer's Directory. Readers are urged to use caution in arranging trades and references should be mutually exchanged.

AIRPLANES

PIETENPOL AIR-CAMPER WANTED, 2-place ship with Model "A" Ford engine in good condition. Will trade a Harley-Davidson motorcycle in perfect condition, Model 74, with extras. Will pay difference in cash.—Arthur C. Hyde, Box 64, Moorefield, Va.

OX-5 TRAVEL AIR in excellent shape. Will trade for a 2-place Aeronca or what have you?—A. Kuball, Jr., Dresden, N. Dak.

AIRPLANE WANTED, single or 3-place ship. Will also consider a partly finished job or one that needs repairing—less engine. If you have only the fuselage or wings, write to me just the same.—Walter Harper, 11908 Superior Ave., Apt. 4, Cleveland, Ohio.

CURTISS PUSHER WANTED, a Bleriot Monoplane or other pre-war plane. Also want Roberts, Maximotor or other pre-war engines. Can also use Thomas-Morse Scout, Nieuport, Sopwith Camel or Spad. Will trade latest model cabin monoplane for these old timers.—Billy Parker, Phillips Petroleum Co., Bartlesville, Okla.

HEATH PARASOL in good flying condition, Heath converted engine and good prop. A-1 condition, now flying. Will swap for a good used car or motorcycle. Will trade engine separately. What have you?—Donald Simmons, Stocton Airport, Stocton, Ill.

OX-5 EAGLEROCK, unlicensed, Millerized. In good flying condition. Will trade for a small lightplane, single place, in good flying condition.—M. M. Garvin, 510 N. Meridian, Indianapolis, Indiana.

CHURCH MIDWING, will trade for an outboard motor, car or what have you? Plane lacks engine and one wing needs recovering.—Louis Geardon, Box 7, Normal Station, Memphis, Tenn.

HEATH PARASOL or Curtiss, Jr., Pusher wanted. Must be in good condition. Will trade good car.—Joe Forehand, Ozono, Tex.

AIRPLANE WANTED, single or 2-place monoplane. Will take a rebuild job, less the engine. What do you want?—Cletus Joge, 512 Clinton, Martins Ferry, Ohio.

LIGHTPLANE, complete but without engine. Will trade even for any kind of automobile.—Fred Quick, South Bunn Road, Bloomington, Ill.

HESS BLUE-BIRD, 3-place, O. C. biplane, complete except for engine and covering. A keen job when fixed up. Will trade for late model twin motorcycle or lightplane in flying condition.—Edward J. Mechsner, Norton, Kan., R. 3.

LICENSED LIGHTPLANE WANTED, single or 2-place job. Must be in flying order. Have new 9-cyl. LeRhone (dismantled) complete with many spares and prop. Also many books and magazines.—R. G. Davidson, 4048 Cold Spring Lane, Baltimore, Md.

WACO "10," 3-passenger type. All parts except wheels, tires, lower left wing and engine. Can be flown with OX-5 or Dayton Bear, 125 h. p. engine. Wish 2-place lightplane.—Delbert Colley, Grace Ave., Barnesville, Ohio.

AIRPLANE SUPPLIES—PARTS—PLANS

AIRPLANE SUPPLIES, aircraft turnbuckles, ¾ in. spark plugs in A-1 condition; Rudex Oleo; pulleys; motor primers; 6 x 12 windshield frames; super-tone accordion, 21 treble keys; and a lot of other items. What have you?—John Correll, 225 W. Water St., Middletown, Pa.

WING STRUT FITTINGS (outer), engine mount fittings, rudder post, torque tube pulleys, tail hinges, control horns, etc., for Pietenpol Air-Camper. Will trade for a good pair of goggles.—W. Ford Lehman, Mt. Eaton, Ohio.

JENNY PARTS, including turnbuckles, dual control system, wheels (less tires). In good condition. Will trade for model airplane supplies, photographic supplies or what have you?—Walter Kirst, 551—7th Ave. S., Clinton, Iowa.

GOGGLES WANTED—prefer sponge rubber cushions. Also want helmet and leather flying suit. I have Heath plans, OX-5 prop (split), four Hisso props and miscellaneous parts. What do you want?—Chester J. Decker, 84 Cambridge Pl., Glen Rock, N. J.

PIETENPOL PLANS for Skyscout. Will take anything of value.—Jack Craig, 721 East 9th St., Oklahoma City, Okla.

HEATH PARASOL WINGS, fuselage and tail unit. New, excellent workmanship. Will exchange for a screw cutting lathe in good condition.—Emery Ohlenkamp, R. F. D. 1, Box 51, Grant Park, Ill.

WARNER TACHOMETERS (2), aircraft oil gauges, lightweight throttles, pulleys, hundreds of turnbuckles and lots of other parts. Will trade for lightplane parts. What have you?—Raymond Duffey, 160 Mahncke Court, San Antonio, Texas.

LIGHTPLANE BLUE-PRINT, detailed. Will exchange for 16 mm. movie camera.—B. E. Norton, Richfield Springs, N. Y.

AMERICAN EAGLET TAIL, Smith motor wheel, 4-cyl. Bosch mag and other things to trade for Pietenpol Air-Camper blue-prints and materials, etc.—F. L. Webber, R. F. D. 2, Newport, R. I.

NOTICE

Due to the limited space available for this department, we are unable to publish all *Swaps* submitted.

We will continue to publish as many as possible—and as soon as possible. However, please be patient if your *Swap* does not appear immediately; remember that there is a long waiting list ahead.

AIRCRAFT SUPPLIES, new altimeters, aircraft switches, banking indicators. Will exchange for parts of 74 cu. in. Harley-Davidson motorcycle, magneto, tires, battery, rear sprocket, helmet or folding camera. What have you?—A. Courtines, 10 E. Green St., Johnstown, New York.

AIRWHEELS WANTED, two wheels and tires, sizes 16 x 7 x 5, without brakes. What do you want?—Hallett Williams, c/o Mrs. K. R. Winslow, Route 3, Elizabeth City, N. C.

BARLING FUSELAGE, cowling, complete tail assembly, one side of landing gear, fuselage partly rebuilt for speed. A complete M. G. H. monobiplane less motor and instruments. Also many other parts. I wish to swap them for a 30-60 h. p. engine, aircooled, radial or in-line, or what have you?—Chas. T. Jensen, 1427 52nd St., Sacramento, Calif.

NORTHRUP BLUEPRINTS, P. A. G., to exchange for blue prints of the Heath Model V, welded type.—A. L. Gardner, 740 West Main St., Conneaut, Ohio.

PARACHUTE, silk, seat-pack in excellent condition. Cost $420. Not approved. Will trade for a Velie M-5 engine.—Dan Atkinson, 1541 W. Oak St., Ft. Collins, Colo.

EAGLEROCK FUSELAGE complete, complete tail-group, gas tank, controls, instruments, landing gear (less wheels), streamline wires, repairable lower wings and ailerons. Will exchange for lightplane fuselage, tail-group and landing gear. What am I offered?—R. L. Briant, Carencro, La.

HEATH WINGS complete, Lawrance engine (less con rods), single place welded steel fuselage, controls, landing gear, motor mount and tail group. I want a motorcycle, boat or what have you?—Jack Millin, 9322—210 Place, Bellaire, Queens, L. I.

AIRPLANE SUPPLIES, course protractor, Pioneer and Pathfinder compasses, landing lights, airplane welding torch (Oxweld) with six tips, 1-Hartzell prop, 5'8" diam., 5'0" pitch (never used), complete set of Waco "10" tail surfaces, covered, and complete set of Travel Air tail surfaces (Covered). Waco "10" ailerons. OX-5 engine and OX-5 parts. Will trade for anything, what have you?—John Hunt, Scott Airport, Yorkville, Ohio.

AUTOMOBILES

1932 PLYMOUTH COUPE, with Atwater-Kent Radio, many extras, like new. Wish to trade for 2-place or 3-place licensed plane. Will pay some cash difference.—Theo. Rousseau, Box 18, Laplant, S. Dak.

1929 DURANT SEDAN, 6-cylinder, in good condition. Will trade for 2-place or 3-place plane.—Bill Mahar, Hettinger, N. Dak.

RACING CAR WANTED. Must be fit for dirt or board track and must be located in Ohio. Will trade a speed biplane complete with instruments, prop and engine for the car.—John Jay Nessy, Jr., 5529 Flowerdale Ave., Cleveland, Ohio.

OAKLAND ROADSTER, Model 31, in A-1 condition and just overhauled. Will trade the car for a Pietenpol Air-Camper or similar lightplane eligible for a license. Would like to get blue-prints of the Air-Camper. What do you want?—Stanley Sovina, 432 Beaumont St., Warrior Run, Peely, Pa.

1931 OAKLAND COUPE in excellent condition, two spare wheels and tires mounted on fenders. Will trade for a single or 2-place licensed lightplane. Have 12 issues of POPULAR AVIATION will trade for a helmet and goggles or some English flying magazines.—Jerre M. Olson, Box 1, Strum, Wis.

SPECIAL SIX NASH, 1928 convertible Coupe. Will trade for a single or 2-place airplane in good condition. Henderson engine preferred. The car has four new tires, new battery, 2-color paint job, rumble seat and set of $90.00 bullet headlights. What have you?—Raymond Goucher, 11 Ft. Hill St., Fort Fairfield, Me.

CHRYSLER ROYAL COUPE in perfect condition. Will trade for Aeronca, Davis, Monocoupe, Fairchild 22 or a slightly damaged higher priced ship.—Walter Harper, 11908 Superior Ave., Apt. 4, Cleveland, Ohio.

BOATS—HYDROS

RACING HYDROPLANE, Pate-Parks outboard racing type. A 11'6" custom built outboard speedster hull, a Utah magnetic speaker, Servel Electric Refrigerator 2-cyl compressor. Will trade for anything you have, preferably a good small plane or a motorcycle.—Carl Funke, 2754 W. Franklin St., Evansville, Ind.

RACING HYDROPLANE. Johnson Class B, 40 m. p. h., brand new, and has trailer. A winner. Also a 5-pass. speedboat with a Johnson 16 h. p. motor, does 30 m. p. h. Harley-Davidson 74 motorcycle. Will trade either of the boats and all the other articles for a 2-place or 3-place licensed plane. Will deliver.—H. G. Lonsway, 142 Ulysses St., Pittsburgh, Pa.

HYDROPLANE water-skipper, 20 foot span (less motor), instruments and covering. Built by licensed mechanic. Has welded fuselage. Also have new 20 x 4 wheels, tires and tubes. Will trade for a good used motorcycle.—T. I. McCoy, 505 Haley Ave., Napoleon, Ohio.

BOOKS—MAGAZINES

BOOKS. Will exchange books for airmail stamps.—O. A. Bell, 529 Monroe St., Port Clinton, Ohio.

CLIPPINGS from Liberty Mag., the serial story, "Red Knight of Germany"—good clear pictures. Also have clippings of the most famous flights. What am I offered?—William Lowe, Jr., 210 Truax St., San Antonio, Tex.

BOOKS AND MAGS. 150 mags, mostly Pop Mechanics and Pop Science. Want plans for model gas engine, model plane parts, or cor-

respondence courses.—J. N. Stoody, 6013 12th Ave., Kenosha, Wis.

COLLEGE TEXTS, Economic Principles and Problems by "Edie" and Elements of Sociology by Dawson Gettys. Will exchange for lightplane blueprints or anything I can use.—J. Correals, 3006 33rd St., Astoria, N. Y.

CORRESPONDENCE COURSES

AVIATION COURSE, 6 lessons in course. Have over 25 courses. Will trade for photos or what have you?—Ray Finch, 609 Graham St., Racine, Wisconsin.

AVIATION COURSE (A. S. A.) Complete. Also a Pilot Wasp radio complete, 3-tubes, 15-500 meters, less battery. Will trade for a Harley-Davidson Twin engine with prop. Will also consider other small aircooled engine.—Anthony Rolando, 454 S. Third St., Kankakee, Ill.

A. S. A. COURSE on aviation, cost $60. The book Aeronautics by Hilton F. Lusk, cost $3.25. Will consider anything in trade such as a typewriter, Page's Aviation Engines (both vols.) or a light motorcycle.—Frank Baumstark, Glen Ullin, N. Dak., Box 313.

COURSES by the University of Wisconsin, complete with corrected papers. One course in German, the other course in Elementary Chemistry. Will trade for other courses, lightplane engine or what have you?—J. N. Stoody, 6013 12th Ave., Kenosha, Wis.

CIVIL SERVICE COURSE (combined Railway Postal Clerk). Also a $165 Conn Baritone instrument. Will trade for something worth about $100. Prefer lightplane, airplane engine, motorcycle or parachute. Will pay difference if worth it. What have you to offer?—Sterling Hostetler, Topeka, Ind.

ENGINES—MOTORS—PARTS

CURTISS OXX-6 ENGINE complete with mags, carbureter and prop. Also an OX-5 prop hub, OX-5 valve gear, OX-5 carbureter, altimeter. What have you to trade? —John Niemier, 12702 Benwood Ave., Cleveland, Ohio.

CURTISS OX-5 ENGINE, spare parts. Also 180 h. p. Hisso engine, Hamilton all-metal pontoons. Want a late Chevrolet 6, or will trade any item for new Hamilton propeller suited to 180 h. p. Hsso.—Wm. Leithold, Hayward, Wis.

AERO ENGINE WANTED. Wish to trade for a 20-65 h. p. engine. Have Model 11 Remington, auto loading 20g. Shotgun (new) or a Model 24 Remington autoloading 0.22 rifle, slightly used. —D. G. Reynolds, R. R. 2, Converse, Ind.

HEATH-HENDERSON converted engine, prop, cowling, mount, etc. Will trade for instruments or what have you? Also have Jenny parts, chute rip-cords and other parts to trade. —Michael Fuller, 4012 Carlisle Ave., Baltimore, Maryland.

SHAW BICYCLE ENGINE and 1-tube radio set, both in good order. Together they are worth $10. What have you to trade?—Red Raddatz, 805 S. Fifth St., Stillwater, Minn.

ANZANI ENGINE WANTED, 6 cyl, 60-80 h. p. in good shape. Also a prop for this engine. What do you want?—H. G. Warner, Fountaintown, Indiana.

OUTBOARD MOTOR wanted in reasonably good shape. What do you want?—Herbert Sefton, Brownstown, Ill.

AIRPLANE ENGINE WANTED, 30-50 h. p. Write particulars to Emery J. Dietrich, Horner Ave., Kansas City, Kan.

EXCELSIOR TWIN ENGINE, aviation goggles, camera, film and set of salesmens' books. To trade for a good primary glider. Have much more to offer.—H. A. Sommers, Ewen, Mich.

MAGNETOS. A Splitdorf 12-cyl airplane magneto and Bosch DU4 4-cyl magneto. Will trade one or both for a battery radio or a ½ h. p. to 2 h. p. gasoline engine.—O. R. Gordon, Woodbridge, Va.

MODEL T FORD special counterbalanced crankshaft. Will trade for a Raja, Fronty or similar valve-in-head for Model T. Must be complete. —Bill Sunvision, P. O. Box 100, Melvin, Tex.

2-MAYTAG ENGINES, Model T Ford Engine and parts, Bicycle (new tires), 12g. D. B. shotgun, electric motor, electric fan, all in good condition. Will swap for late model used motorcycle, lightplane engine or what have you?—Robert Williams, 227 N. 8th St., Sterling, Kansas.

VELIE ENGINE (cracked). Will trade for chute, instruments or what have you?—Lester Pierce, 523 T St., Eureka, Cal.

FORD "A" WANTED, converted, or any other engine developing 40-50 h. p. that does not weigh more than 225 lbs. Let me know what you want.—R. G. Shampagne, 5810 Third Ave., Rosemont, Montreal, P. Q., Canada.

EVANS CYCLE ENGINE, 1½ h.p., 2 cycle, aircooled, magneto ignition. Also one 8-cyl Dixie mag. Will trade for lightplane parts such as prop, fuselage or wing.—Richard Beyer, Aberdeen Proving Ground, Md.

INDIAN CHIEF MOTORCYCLE ENGINE, 2-cyl. Also unassembled 2-cyl Indian Scout and 2-cyl Excelsior. Model T Ford engine parts. Radios and parts, books and magazines. Will trade for lightplane parts, typewriter or what have you?—S. Pollack, Box 86, Mastic, N. Y.

HENDERSON ENGINE, 4-cyl, less cover plate. Will trade for a pair of 16 x 4 airplane wheels complete with tires. Also have a MAYTAG engine that I will trade for wing ribs or anything in the line of airplane parts?—Calvin F. Harrington, 2441 Cedar St., Anderson, Ind.

AERO ENGINE WANTED, about 30 h.p., or aero engine parts. Will trade small saw powered by washing machine motor, short-wave radio parts, and many other things. If you have what I want, will also pay cash difference.—Chas. Catorzaro, 5432 Emerson Ave., St. Louis, Mo.

GUNS—SPORTING GOODS

BENJAMIN AIR-RIFLE, automatic 25 shot, value $8.00. Will trade for a typewriter in good condition, or what have you?—Walter McGuire, 202 Volk St., Portage, Wis.

SHOT-GUN, single shot, German gas mask and case, German Helmet, 6-tube Bosch Radio, steel fishing rod and reel. Will trade for helmet, goggles, 10x3 aircraft tires and tubes or aircraft instruments.—Chas. Kinch, Los Altos, Calif.

PISTOL, Smith & Wesson pistol and a Model "T" Ford Engine. Will trade for a fuselage or other aircraft parts.—J. T. Wassom, Jr., 510 W. Main St., Wytheville, Va.

SPRINGFIELD SHOTGUN, 12g., single barrel, brand new. Also Russian army rifle, cut down and bored for 30-06 cart. and a Ranger bike. Will trade either of these for an Indian Scout, 37, engine, less mag, trans, clutch and carbureter.—Walter Gross, 262 Locust Ave., Amsterdam, N. Y.

H & R REVOLVER, 0.22 cal. in A-1 condition. Also a pair of leather puttees practically new. Have many other things. Will trade for an air-speed indicator and pitot tube.—Ken Schroeder, Wilton, Wis.

GLIDERS

HANG-GLIDER, span 28'-0", chord 6'-0", value $40. Will trade for a motorcycle or what have you?—R. G. Smith, 67 Wallkill Ave., Middletown, N. Y.

GLIDER WINGS WANTED. Have radio parts, bicycle, electric trains and books.—Adrian Bos, Jr., 180 Suffolk Road, Island Park, N. Y.

NORTHRUP P. T. G. BLUEPRINTS to exchange for blueprints of the Heath Model V, welded type.—A. L. Gardner, 740 West Main St. Conneaut, Ohio.

JEWELRY—WATCHES

DIAMONDS. Will trade a 51 point blue-white diamond or a 65 point blue-white diamond for an airplane. What sort of ship have you?—Olie A. Bruton, Lamesa, Tex.

HAMILTON WATCH, new, 14k. white gold, 12 size, cost $172. Will exchange for a used lightplane. Will consider one that has been slightly cracked.—L. W. Hoyt, De Land, Fla.

WRIST WATCH, costing $36, double-barrel shot-gun, 0.22 cal. repeating rfle, bicycle without front wheel. Will exchange for a glider.—William Rombold, R. F. D. 1, care of David Rombold, Sharon, Pa.

MISCELLANEOUS ITEMS

HARD LABOR will be exchanged for lessons in flying, for a glider or a motorcycle.—Wilbur Bright, 2137 N. 8th. St., Akron, Ohio.

SOLDIER'S BONUS POLICY. Will trade for a 2 place or 3-place ship in good flying condition. The policy is worth $789.50 with a little additional interest and it will probably mature within 12-18 months.—Guy W. Wheaton, Box 193, Seneca, Ill.

HARD WORK will be exchanged for flying time on an up-to-date mechanic's course.—Miss Mary Winstanley (P-25028), 1444 Dill Ave., South Euclid, Ohio. (East Cleveland).

MUSICAL INSTRUMENTS. A $60 trombone, professional guitar, brand new bolt action repeating rifle, shotgun, pump action rifle (used) together with a number of aviation books and mags. Will trade for a lightplane or a crackup.—Ray Helker, 400 Hyde Park Ave., Waukesha, Wis.

OIL-PAINTINGS, outdoor scenes in summer, spring or fall. Will swap for ready built airplane models. They must be complete and workmanlike.—E. E. Shaffer, Paris, Ark.

MOVIE FILM, 20 reels of 1,000 feet each. Will trade for any mechanical apparatus such as an aero-engine of any h.p., an old car, motorcycle or a wood-working lathe. Will trade a few or all of the reels. What have you?—A. E. Padilla, 1067 W. Harrison St., Chicago, Ill.

UNDERWOOD TYPEWRITER. Will trade for reasonable offers.—L. E. Kuszmaul, 2634 S. Massey St., Philadelphia, Pa.

L. C. SMITH TYPEWRITER, desk type, std. keyboard. Will exchange for a screw-cutting bench lathe, accessories included. Must be in good condition or easily repairable and not too far away.—Charles Reburn, 23 Avenue C, Claymant, Del.

KELSEY PRINTING PRESS, 5x8 with accessories and a 2¼x3¼ camera, F4.5 speed lens and mask for miniature snaps. Will trade for a 5x7 Korona Junior Camera with F6.3 lens in Betax shutter. Bonafide references required. —Earl E. Tiley, 509 E. Cherry St., Blanchester, Ohio.

REAL ESTATE. Have a well located lot. 135x 160 feet, with water, gas and electricity. Will trade, with some cash, for a licensed plane. I also have a 4-cyl. Henderson motor. What have you?—Don Durfee, Williamsville, Erie County, N. Y.

STRESS ANALYSIS. Will make a stress analysis of a lightplane design in exchange for a lightplane engine in good condition. Will also make performance computations in exchange for lightplane wheels or what have you?—George Fertig, 9407-114 Ave., Edmonton, Alta., Canada.

MODELS—MODEL SUPPLIES

MODEL PLANS. I have many model plans to exchange, also copies of the Model Maker's Manual that I will trade for airplane photos. Have some model kits that I might consider trading. What have you?—Ray Solly, 3046 Keating Ave., Chicago, Ill.

MODEL PLANS WANTED of non-flying scale models, showing joy-stick, seats, etc. Also interested in blueprints of real planes that show all details. What do you want for these plans?—Roy Rogers, 595 Carling Ave., Macon, Ga.

FLYING SCALE MODELS made to order. I want a pair of Mallard duck decoys or any kind of a typewriter.—William Crosby, 364 Lincoln Ave., Saugus, Mass.

MODEL RAILROAD. Lionel O ga. Loco, 3-pass cars, 7-freights, 50 pcs. track including switches and X.T-transformer. Cost $75. Will trade for books on airplane rigging. Aircraft Engine Instructor, simple aerodynamics, and Von Hoffman correspondence course.—J. U. Mowll, Mathews, Va.

MODEL PLANS of the Travel Air monocoupe, Waco Taperwing, Doolittle's Gee-Bee, Heath Parasol, Shooting Star, Boeing Fighter F4B-3 and the Monocoupe. What have you?—Francis Krump, 1047 Reynolds Ave., Kansas City, Kan.

MOTORCYCLES

MOTORCYCLE WANTED. Have several things to exchange with some additional cash if required.—David Smith, 139-15-223 St., Laurelton, N. Y.

HARLEY-DAVIDSON, Model 74, Twin, with new tires, battery and paint job. In perfect running condition. Will trade for a single or 2-place airworthy lightplane.—J. Russell Craw, R. F. D. 1, Moundsville, W. Va.

1929 HARLEY-DAVIDSON, Big Twin motorcycle. Also a 3-place licensed OX-5 Monarch airplane and an unlicensed single-place biplane without engine. Will trade for a Velie MS Monocoupe, less engine, or what have you?—Wallace Aug, R-4, Rockford, Ill.

2-HARLEY-DAVIDSONS, 1928 and 1932 models. Both in good shape. Will trade for a lightplane an Aeronca preferred. Will also consider an OX-5 job.—Winsor Ford, care of Batts Bros., Springfield, Tenn.

XUM

SPANISH GALLEON
6 in. Model

MAYFLOWER
6in. Model

Get Going on this New Idea!

Build These

Here's your chance to try something entirely new. Beautiful, realistic replicas of Historic Ships, each one in a dandy Construction Kit. Now you can make these wonderful Models for only a few cents each. Boy! You'll get a thrill out of this new idea.

Miniature Ship Models

SANTA MARIA
6 in. Model

HALF MOON
6 in. Model

FLYING CLOUD
6 in. Model

CONSTITUTION
6 in. Model

Just look over these pictures at the left. They are real photographs of the Miniature Ship Models you can build with these fine Kits. Of course, the gorgeous coloring doesn't show here, but each Model is a wonderfully true reproduction of the original Ship, and you can finish them in actual colors. Did you ever see anything finer for decorations, in your room or your den, on the radio, over the fire-place, or anywhere else? You can even sell them and earn some money!

Each Kit contains everything required to make one complete Model. You can carve the hull from a balsa block; use round wood for masts, bamboo for spars and yardarms, thread for rigging and paper for sails; railings, deck fittings and other details are printed on sheet balsa. Cement the parts together with cement furnished in the Kit, then color and decorate your Model with materials also furnished. You get a full-size Plan to work from and detailed Instructions for everything; you cannot go wrong—it's all explained for you! This is your chance for a new Model Sport. Look over these Ships, select the ones you like best and get going—there's real sport ahead for you.

Your Choice - any 2 Kits - 60c

4 for $1.20. All 6 for $1.75 Postpaid

POSTPAID

15-in. Size MONOCOUPE Flying Model

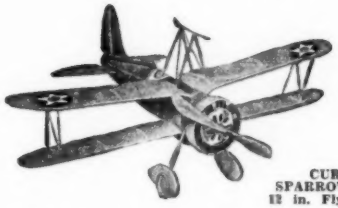
A wonderful Model of this popular Ship, that will give you marvelous flights. Full-fuselage body, cambered wings, carved balsa prop, metal motor plate and other fine features.

Remember, this is a 15 inch Model! The Kit is complete and full-size Plan is included.

Complete Kit 30c

POSTPAID

Here's a New Addition to our 12-inch Flying Models for



CURTISS SPARROW-HAWK
12 in. Flying Model

25c

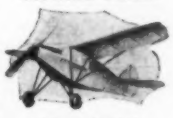
EACH POSTPAID

(No Orders Accepted for Less Than 2 Kits)

BOEING FIGHTER

SOPWITH CAMEL

FOKKER TRIPLANE



PUSS MOTH

POLISH FIGHTER

FOKKER D-VIII

These are the "IDEAL-O-PLANE" Kits that started everybody building small Flying Models. They are unquestionably the leaders of this type of Model Airplane Kit.

Here are seven of the most wanted Models of the day, each one a duplicate of its original, with full fuselage bodies, cambered wings, shock proof landing gear, carved balsa propellers, aluminum motor plates and other features of expensive Models.

Every Model Guaranteed to Fly!

Each Kit is complete, there is nothing more you need to finish a perfect Flying Model. Every part is accurate and true and it a goes together perfectly when you follow the instructions on the big, actual-size Plan. Compare these Kits with any others.

Look over these Models and pick yours. We are passing our big-production savings along to you in a really better Kit for a quarter, but the packing and postage charges are so heavy that we cannot accept any orders for less than two (2) Kits at one time. So send along your order for any two (2) of these fine Models and we will prepay all charges right to your door.

Get Our New Bulletin . . . .

A dandy, big Tabloid Magazine full of new information on Airplane and Ship Models, Fittings and Supplies.

Send a 3c Stamp for your copy now.

IDEAL AEROPLANE & SUPPLY CO., Inc.

22-26 WEST 19th STREET, NEW YORK

Canadian Model Aircraft, 3007 St. Antoine St., Montreal
(Canadian Prices are 40% Higher to Cover Customs Duty)

DEALERS: Write for our Special Proposition on these New Kits. They are money-makers right now.

Airy Chat

(*Continued from page 346*)

hope that Mr. Unruth will have an opportunity of looking the committee over. In the words of the radio star, "I hope you will like them"—in fact I know you will.

* * *

SOMETHING went "clunk" when this letter and a package from John S. Gregory, Eastport, Mich., was laid on the table, and on investigation I found a very nicely executed brazed fitting. We'll let Mr. Gregory tell you the rest of the story.

After reading L. Long's article on brazing in the April issue, I am taking the liberty of mailing you, under separate cover, a sample of the brazed joint that I used on the tail-group of my Heath. As you take so much interest in the lightplane builders, I think the least we can do is pass along any ideas that we may have even if they are not very good, for sometimes the other fellow may be able to get something out of them—I know I have.

You will notice, that by making the strap longer, that three struts may be put in this joint. In testing this job, I have found that the tube will always break above the joint. It is easy to make. All you need is a vise and hack-saw—and as Long said—"anyone can braze."

I thought that this brazing article by Les Long would make a hit with the homebuilders and so it did. We have had numerous favorable comments on it and hope that it has helped a lot of you fellows.

* * *

THERE are two answers to this letter by Fred A. Bussard, 3725 Central Ave., Kansas City, Mo. The first is, "We have" and the second is, "We are going to do it again." This is what he says:

I would like to make a suggestion to your magazine, POPULAR AVIATION. *Why don't you stress the development of light aircraft engines—engines in the 40 to 50 horsepower class? A type that could be built up from automobile parts—aircooled exclusively.*

My suggestion would be an engine built up of Ford "A" parts using iron cylinders with cast aluminum heads, the valves to be set in cylinders of the "L" type. The crankcase to be aluminum.

If the castings were turned out by some foundry and sold direct to the purchaser, I should think that they could be had for a very reasonable price.

The lightplane of today is more in need of a good engine than it is of good design. I know of a number of good planes that can be had at a reasonable price but an engine is very hard to find. A good airplane can wear out two or more engines in its lifetime.

Well, we recently ran a series of articles on how to convert a Ford "A" engine by Pietenpol, and in an issue or so, we will start a new series on how to construct a light air-cooled engine from ready-made castings just as our correspondent suggests. We believe that this new series of articles will fill a long felt want.

* * *

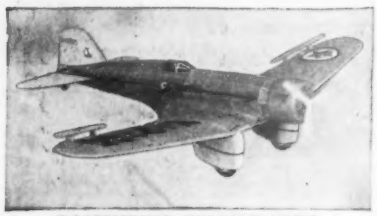
SAY fellows, this is something that you should study. Paul Trant, 454 East 31st St., Erie, Pa., sends in an idea for a safe and sane Fourth of July display. He fills a bottle full of lightning bugs and then drops the bottle of incandescent horseflies with a parachute. It's true—we have the drawing! Maybe he could get the U. S. Army Air Corps to use his stunt to take the place of flares, but even the whole army would have a lot of trouble running down enough bugs to make it worth while.

* * *

EVERYTHING has to close sometime, so here's where the end of this column comes. See how nice it fits this page. I'll be seeing you next month in the same place. J. B. R.

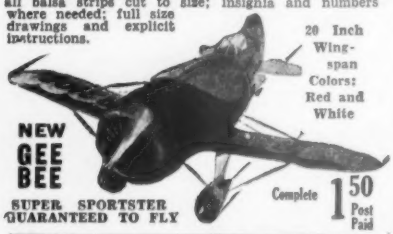
NEW CAPT. HAWKS' SKY CHIEF
"NORTHROP GAMMA"

Easy to build—Flies great. Here's one of the sweetest flying models you ever flew. Snappy, speedy lines, big 22" tapered wing, length 13½", weight 1 oz. Kit is complete, including finished cowling, wheels, and semi-finished prop. Full size plans and instructions. Send for yours now. **1.00 POST PAID**



SCIENTIFIC FLYING KITS

All Scientific flying kits contain: Ready-made balsa cowling; ready-made wire fittings; all ribs, bulkheads, etc., clearly printed on balsa; semi-finished propeller, and pants; 1 oz. banana oil and cement (and colored dope where needed); tissue; rubber; all balsa stripe cut to size; insignia and numbers where needed; full size drawings and explicit instructions.



20 Inch Wingspan Colors: Red and White

NEW GEE BEE SUPER SPORTSTER GUARANTEED TO FLY

Complete **1.50** Post Paid

20½" STINSON AIRLINER TRI-MOTOR—COMPLETE KIT **1.50** Post Paid

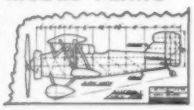
2 FOOT MONOCOUPE COMPLETE KIT—Send for it NOW **1.00** Post Paid

FREE Complete 1933 Price List and Catalog. Send 3c to cover postage.

SCIENTIFIC MODEL AIRPLANE COMPANY
277 Halsey St. (Dept. P-6) Newark, N. J.

SENSATIONAL MODEL PLANS

You can easily build big, snappy, FLYING SCALE MODELS from these sensational designs developed by America's foremost model engineer. —Every piece detailed— Accurate, full size patterns and layouts actually SAVE 35% to 45% OF CONSTRUCTION TIME. Use bulk supplies and CUT COSTS IN HALF.

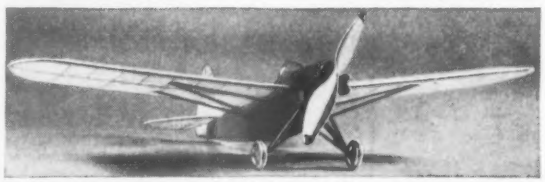


Hurry!! Order Several of these Big Plans Today
Only 25c each or 3 for 60c

25" Akron Fighter F9C2	20" Fokker D-VII
18" Ben Howard's Ike	20" Gee Bee Super Sportster
24" Bellanca Seaplane	24" Lockheed Orion
20" Boeing P-26 (XP 936)	18" Nieuport "28"
30" Boeing Bomber	18" Pfalz Triplane
30" Curtiss A-8 Attack	20" Polish PZL-6
30" Curtiss Army Hawk P6E	20" Spad, Type 13
30" Curtiss Hell Diver	20" Sopwith Camel
24" DH Moth Biplane	20" Wedell Williams Racer

VIKING AIRCRAFT CO., Dept. 26, Hamilton, Ohio

NEW! DELUXE HEATH CENTER WING
with Flashy Aluminum Wheels



ONLY 85c
POSTPAID
Catalog FREE . . . with 10c

Every customer says Red Birds are the biggest value in the whole industry! Newer designs. More complete kits. Full scale blue-prints. Lowest prices. And, so easy to build! This sensational new Center-Wing is worth Double the Price! Full 19⅜ inch wing span. Weighs ⅞ oz. Makes a great prize-winning flyer, perfectly balanced for distance flights. Extra large, attractive kit contains all wood parts—and then some! New flashy aluminum wheels, 2 celluloid cylinders. Cut-out propeller blank. Colored tissue for red fuseage and white wings, tail. Tube of glue. Large bottle genuine aircraft dope. All wire parts. FULL SCALE BLUEPRINT! Be sure to get this one!

Great big 24-inch perfect-scale model of Army Boeing Fighter! One of greatest Red Bird sellers. A joy to build—a thriller to fly! 5-piece kit is a wonder! Buddy Hagan, Ills., writes, "My Boeing P-12E is a beauty. Loops, dives, spins and comes to a 3-point landing." Specially reduced price ..... **$2.25** Postpaid

FREE! With each kit you get free copy of new 1933 Red Bird book, 10c value. Or—send 10c, coin or stamps, for book and get 2 pairs beautiful 3-color insignias, free. Learn how you can earn a Red Bird kit FREE. Mail order for kit or book—TODAY!

RED BIRD MODEL AIRPLANE & SUPPLY CO.
1918 Emmet St. Omaha, Nebr.

FRONT PAGE NEWS

AN IMPORTANT, NEW LOW PRICE CREATION

Offered Exclusively by Selley

DEALERS WANTED

KNIFE CUT BALSA

PERFECT WOOD

100% better than saw-cut sticks

AT LAST! The model builder's dream realized! SELLEY scores the greatest beat in history! The first and only improvement in balsa wood production! After two years experimenting, SELLEY has created and perfected a semi-automatic machine that produces fine selected white balsa strips of INCREASED STRENGTH, PERFECTLY STRAIGHT, ABSOLUTELY ACCURATE TO SIZE, AND GLASS SMOOTH ON ALL FOUR SIDES!

Only due to the tremendous production, with no waste, can we offer these NEW LOW PRICES, passing the SAVINGS on to you!

Compare this wood with saw-cut balsa. Sawteeth tear the fibres, weaken the strength and produce uneven, inaccurate sized sticks.

Our new knife compresses the fibres and actually increases the strength of the wood. SELLEY ALONE can supply you with any stick from 1/64" sq. to 3/16" sq. perfectly straight, uniform and accurate to size! Order now and stock in on all sizes!

Minimum postage charge 15c

LATA BALSA SPRAYS

18" Lengths

1/32" x 1/64"	80	for 5c
1/32"	40	for 5c
1/16"	40	for 5c
3/32"	40	for 5c
1/16" x 1/16"	46	for 5c
3/32"	46	for 5c
1/8"	46	for 5c
3/32" x 3/32"	30	for 5c
1/8"	30	for 5c
1/8" x 1/8"	24	for 5c
3/16"	24	for 5c
1/4"	12	for 5c
3/16" x 3/16"	16	for 5c
1/4" x 1/4"	12	for 6c
3/8"	3	for 5c
3/8" x 3/8"	2	for 5c
1/2"	2	for 6c
1/2" x 1/2"	2	for 7c

LATA BALSA LOGS

36" Lengths

1" x 1"	$ .10 each
1" x 2"	.17 each
1" x 3"	.25 each
1" x 6"	.50 each
1½" x 1½"	.23 each
2" x 3"	.34 each
2" x 3"	.50 each
2" x 4"	.68 each
2" x 6"	1.00 each
3" x 3"	.75 each
3" x 6"	1.50 each

Balsa Propeller Blocks

3/8" x 1/2" x 5"	4 for 5c
1/2" x 3/4" x 6"	3 for 5c
5/8" x 1" x 7"	2 for.. 5c
5/8" x 1" x 8"	2 for.. 6c
7/8" x 1 1/8" x 9"	4c each
1" x 1 1/8" x 10"	5c each
1" x 1 1/4" x 12"	8c each

LATA BALSA SHEETS

18" Lengths

1/54" x 2"	15c for 10
3"	30c for 10
1/32" x 2"	15c for 10
3"	5c each
6"	12c each
1/16" x 2"	7c for 4
3"	5c each
6"	12c each
3/32" x 2"	2c each
3"	5c each
6"	12c each
1/8" x 2"	2c each
3"	5c each
6"	12c each
3/16" x 2"	2 for 5c
3"	5c each
6"	12c each
1/4" x 2"	3c each
3"	6c each
6"	15c each
1/2" x 2"	5c each
3"	9c each
6"	18c each

Postage 10c per Log

THESE 14" FLYING KIT VALUES

CURTISS NAVY RACER

ARE GOING OVER BIG!

NO WONDER! They are accurately designed, realistic flying scale models embracing the same quality that thousands of boys enjoyed in SELLEY'S much higher priced kits. Remember this! NOTHING IS CHANGED BUT THE PRICE AND THE PRICE IS THE LOWEST IN OUR HISTORY! Large scale production makes these extraordinary bargains possible without sacrificing SELLEY'S enviable reputation for superior model products.. It pays to buy from the leader! Now choose the finest flying kits and save! Pick your favorites and send in your order today!

25c

VERVILLE AIR COACH
HEATH PARASOL
CURTISS NAVY RACER
AIRONCA
FAIRCHILD

POSTAGE
10c for every two kits
20c for four kits
30c for 6 kits

Space prohibits illustrating all six 25c models

THESE 18 in. FLYING KIT WONDERS ARE WINNING

GEE-BEE SUPER SPORTSTER

Nation-wide POPULARITY!

Every model is packed in a separate box, labeled and sealed and comes complete with full size 3-view plan, layout sheet with all details clearly shown, SPECIAL MACHINE TURNED BALSA COWLS, PROP, HUB, WHEELS. Printed balsa rib and bulkhead sheet, colored tissue, cement, music wire, rubber, reed, bamboo, printed motor dash-board, insignia sheet and best grade balsa sized sticks. What a value! Select yours NOW!

95c EACH

WEDELL WILLIAMS,
A-8 ATTACK,
BOEING P-26
GEE BEE SPORTSTER

Postage 15c
West of Miss. 25c

Space prohibits illustrating all four models

Plans Alone 25c Each

CURTISS A-8 ATTACK

NOW SELLEY WHEELS COST LESS

The largest and lowest-priced selection in the world

Aluminum Disc Rubber Tired Tail Wheel

½" dia.	5c ea.
⅝" dia.	6c ea.
¾" dia.	7c ea.
⅞" dia.	8c ea.
1" dia.	9c ea.
1⅛" dia.	10c ea.
1¼" dia.	11c ea.

Balloon Tire Alum. Disc

1½" dia.	25c pr.
1¾" dia.	30c pr.
2" dia.	40c pr.

Aluminum Disc Rubber Tired Air Wheels

1" dia.	18c pr.
1¼" dia.	20c pr.
1½" dia.	25c pr.

Treaded Rubber Aluminum Disc

1 3/16" dia.	30c pr.
1½" dia.	40c pr.
2" dia.	50c pr.
3" dia.	60c pr.
5⅜" dia.	$1.25 pr.

Balsa Wheels Balloon Tire Shape

½"	.5c pr.
⅝"	.6c pr.
1"	.7c pr.
1¼"	.8c pr.
1⅞"	.15c pr.

Postage on Rubber Tired Wheels 4c; Untired, 3c pr.

Celluloid Untired

¾" dia.	6c pr.
1" dia.	8c pr.
1⅜" dia.	10c pr.
1⅞" dia.	16c pr.
3" dia.	40c pr

Celluloid Pants

¾" or 1" Whl. 25c pr.
1⅜" or 1⅞" Whl. 30c pr.

Celluloid Air Wheels

¾" dia.	8c pr.
1" dia.	10c pr.

Bal. Tired Cel. Disc Whl.

1½" dia.	.30c pr.
1¾" dia.	.35c pr.
2" dia.	.45c pr.

BALSA SPRAYS

ONLY 5¢ 80 Strips

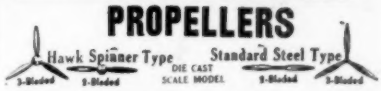
Read This For Your Protection

Every SELLEY product is guaranteed to be the best obtainable and is manufactured in the largest and most modern factory in the world. You may safely choose any construction set or accessory and if it does not meet with your entire satisfaction your money will be immediately refunded!

Selley Alone Can Make This Broad Guarantee!

The Lowest Prices Ever Offered on *Selley's* Model Supplies!

PROPELLERS



2-Bladed	3-Bladed	2-Bladed	3-Bladed
3¼" .25		3¼" .20	
4" .30	4" .35	4" .25	4" .30
4½" .35	4½" .45	4½" .25	4½" .40
5" .35	5" .50	5" .30	5" .45
5⅝" .40	5⅝" .60	5½" .35	6" .60
6¼" .40	6¼" .70	6" .40	
7" .55	7" .80	6½" .45	7" .70
8" .65	8" .90	6¾" .50	8" .80
9" .75	9" 1.00	8" .60	9" .90
10" .85	10" 1.10	9" .70	10" 1.00
11" .95	11" 1.25	10" .80	
12" 1.10	12" 1.50	12" 1.00	12" 1.25

The following sizes are supplied with adjustable blades with special hub, clamping rings and safety screws.

15" $6.00	15" $7.00	15" $5.00	15" $6.00
18" 7.00	18" 8.00	18" 6.00	18" 7.00
21" 8.00	21" 9.00	21" 6.50	21" 8.00
25" 8.50	24" 10.00	24" 7.00	24" 8.50

Packing and Postage 3c each up to 6" dia., 6c each up to 12" dia., 12c each up to 24"

SPUN ALUMINUM COWLS

Diameter	Anti-Drag	Open Cowl	Closed Cowl
1½"	.20	.20	.20
2"	.25	.25	.25
2½"	.28	.30	.30
3"	.30	.35	.35
3½"	.40	.45	.45
4"	.50	.55	.55
4½"	.75	.80	.75
5"	.90	.95	.90
5½"	1.05	1.10	1.05
6"	1.25	1.30	1.25
7"	1.50	1.60	1.50
8"	2.00	3.25	2.00
9"	2.50	2.75	2.50
10"	3.00	3.25	3.00

Packing and Postage 6c each on sizes up to 4" diameter. 10% of price of cowl on larger sizes.

Send for Airplane Catalog. Send 5c for Boat Catalog.

SELLEY MANUFACTURING COMPANY

1373-P GATES AVENUE, BROOKLYN, NEW YORK

Sportswomen

(*Concluded from page 370*)

The wife of Capt. J. A. Mollison broke her husband's record on the flight south, landing in Cape Town in less that five days. Her time for the return flight was seven days and seven hours, beating the previous record, established two years ago by the Duchess of Bedford and Capt. C. D. Barnard, by about two days. She had hoped to make better time on the return flight.

It has been announced that the Mollisons will attempt a trans-Atlantic flight together this summer. Mrs. Mollison has never visited America though she has probably seen more of Europe and Asia than most people, having flown solo to India, Africa and Australia and across Siberia to Japan.

END.

HELMET and FREE WING EMBLEM $1.00

Get this Aviators Helmet and Wing Design Emblem for your Lapel—Finished in Bronze. Both sent prepaid for $1.00 attached to ad. Goggles illustrated Non-Shatterable $4.50 Combination Helmet-Goggles Emblem $5.00. Avoid C.O.D. charges Send cash or M.O.

SMOOKLER, DEPT. 57, 480 Fifth Ave., New York City

15" Aeronca C-2

15" Fokker DVII

15" Monocoupe

★ STAR ★ FLYERS

15" WING SPREAD

25c Each Complete Plus 5c Postage

2 or more Kits Sent Post Paid

15" Waco—Model C

15" Puss Moth

15" Bellanca Skyrocket

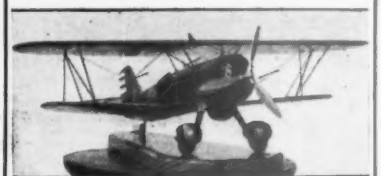
Perfect Scale Models GUARANTEED TO FLY

BEWARE

Don't confuse these kits with ordinary kits now being offered by other firms for 25c. Star Kits are absolutely complete to the last detail and are actually worth $1.00 and more.

STAR MODEL AERO SHOP, 10a Pearl St. Newark, N. J.

12" Ornamental Models



Photograph of the Hawk P-6-E Model

AT LAST. A striking, true scale reproduction of the famous CURTISS HAWK P-6-E and GEE BEE SUPER SPORTSTER at a price that you can afford. Each an art piece of rare beauty and distinction.

AMAZINGLY large and most complete CONSTRUCTION KITS to build these beautiful models for pleasure or profit are now available at the following SPECIAL PRICES: Curtiss Hawk P-6-E 12" Kit, only $1.70 each. Gee Bee S. S. 12" Kit, only $1.80 each. Postage 20c per kit extra. Please remit by Money Order or Check. Stamps not accepted.

Satisfaction Guaranteed or Money Refunded

RUSH 5c for new illustrated descriptive folder and prices of 12" and 20" Finished Models, Kits, and Drawings. Actual photographs only 10c each.

VICTOR STANZEL

High Grade Model Aircraft

SCHULENBURG TEXAS

Model Dept.

(*Continued from page 386*)

the drawings. Note that the inside of the pants is much thicker than the outside.

TAIL WHEEL—STEP NO. 10

The tail wheel is set into a small pant constructed along the same line as those used for the landing gear. The wheel itself is built from two pieces of balsa. The grain of these pieces should run in opposite directions. This tail wheel is cemented to the rear balsa cone which attaches to the fuselage and streamlines the end of the body.

RADIATOR—STEP NO. 11

The radiator is attached underneath the body and forward ½ inch from the landing gear strut. A small piece of balsa approximately ½ inch thick on the lower side and ¾ inch thick on the top side can be used. This part may also be made from a thin piece of stiff paper folded to the proper shape and cemented together. The radiator core should be drawn on the front side.

MACHINE GUNS—STEP NO. 12

The machine guns attach on the outside of the body just opposite the cockpit directly on the center line of thrust. One is placed on each side of the body. The front and top views of the body will illustrate the streamline shape which houses the machine guns permitting only the barrels to protrude from the front.

PROPELLER—STEP NO. 13

The propeller is carved along the general lines explained in these columns in past issues with the addition of a nose spinner which is cemented in place at the center after the propeller shaft has been attached.

The propeller (at the center) should be left the same width and depth for the maximum diameter of the nose spinner. The square part which projects beyond the nose spinner on the front side of the blade can be cut away after the spinner is in place.

COVERING—STEP NO. 14

The model should be covered in sections and assembled after. The body is red and for best results, small sections of tissue should be used between each fairing strip. The rudder is yellow with the correct Army colors of red horizontal stripes and the vertical blue stripe. The stabilizer is covered all yellow and each side is cemented in place afterwards. The wings are all yellow with stars as illustrated in the finished photograph. The outline of the ailerons is shown with a narrow strip of black tissue approximately ⅛ inch wide.

END.

Solid Scale Models

Finished Models complete in all details with Wire Riggings, Insignias and MOVABLE CONTROLS. (U. S.) Boeing F4B-3, Boeing P-12C, Boeing P-26, Curtiss A-8, Curtiss F9C-2 and Curtiss Hawk P-6E. Wingspread 6" to 9". $1.25 each, or 2 for $2.25.

PRICES OUTSIDE THE U. S. 35% HIGHER.

CHRISTIE BATLAS

P. O. Box 149 Morgantown, W. Va.

Corben

(*Continued from page 378*)

issue. The leading edge is nailed and glued in place and after the glue is dry, the ribs are dressed down at the point where they attach to the leading edge so that the rib ends will come flush with the leading edge. The trailing edge is now put into place as shown on Drawing No. 602. All of the nail heads should be soldered to prevent them from working out of place.

The next step is the wing tip which is made of ½ inch steel tubing. Cut a slit in one end as detailed and shape to fit the leading edge. Now bend the tube cold to the curve of the wing tip shown in drawing No. 604. Light gauge galvanized iron strips hold the tip to the spars. Solder the strips to the tubes as well as soldering over the nail heads.

The wing braces should now be nailed and glued in their places as shown. Bolt all of the fittings in their places, using nickel steel aircraft bolts and nuts. You will notice that all of the major fittings are drilled ¼ inch whereas the spars at those points are drilled ⅜ inch, this is where part No. 601-15 comes in. Insert the bushing into the hole in the spar before the fitting is attached.

The false ribs should be nailed along the leading edge as detailed. These ribs are made from aluminum tubing and should be bent to the same curve as the airfoil between the leading edge and the front spar. You will note that the leading edge at the root end is covered with 3/32 inch plywood both top and bottom.

Before the plywood is put on it is necessary to fill in between the first three ribs with ¼ inch square filler strips along the back edge of the spar both top and bottom, after which the plywood is wrapped around the leading edge and nailed and glued in place. Filler strips ¼ inch square are also nailed and glued along the rear spar at the aileron opening. These strips are used both top and bottom and are placed at the rear edge of the spar.

Two ¾ inch square braces are nailed and glued to the rib in line with the aileron pulleys. These strips are to be attached in the same way as those on the root end ribs. This will just about complete the wing (less covering) so we will now start on the aileron. Lay out the spars and false spars in the same manner as you did the wing spars, starting at the root end (the square end) and working out to the tip.

Drill all holes as detailed. Cut the rear portion of the ribs No. 602-2. These ribs should be cut off and then space them along the aileron spar as detailed on drawing No. 604. Slip the false spar in its place, nail and glue the ribs to the spars.

EDITOR'S NOTE. *This series of articles will be continued in our next issue.*

Radio

(*Continued from page* 371)

of his second radio receiving set, designed to pick up the signals of the landing beam for vertical guidance. This is a radio beam extending upward from its transmitter at a slight angle above the horizontal, much in the manner that the beam of a search light extends from its projector.

The radio beam, however, is ellipsoidal in shape, rather than cone shaped as is the light beam. The beam is broadcast on an ultra-high frequency (about 100,000 kilocycles). By means of the signals of this beam, received in his second set, the airman gets an indication on a second needle pointer on the same dial with the radio range indicator. This second needle is horizontal, if the airplane is on the correct line for landing, and swings upward or downward to show, respectively, that the plane is too high or too low.

To facilitate reading, a small circle is painted in the middle of the dial face so that the airman has only to keep the two needles crossed over the circle.

Continuing toward the airport, and flying at about 5 miles per hour faster than normal landing speed, the pilot keeps the needle of the runway beacon at the middle of the dial—pointing vertically—and the needle of the landing beam indicator pointing horizontally. He does this by flying so that the needles cross over the circle in the center of the dial. He is following the center line of the course marked by the runway beacon, but with respect to the landing beam, his indicator directs him along a curved line in the under part of the ellipsoidal beam.

If he were to follow the axis of the landing beam in the line of greatest signal intensity, the signals would become increasingly stronger and the needle would rise above the horizontal. It he dropped too far below the beam the signals received would be weak and the needle would fall. The course followed is a curved one underneath the beam's axis where the signal strength remains constant, and which brings him downward in a sweeping glide, flattened at the end, which is correct for a landing.

Following this unseen radio path, the airman approaches the field. About 1,000 feet before he reaches the edge of the field, notice is given him by a signal from a marker beacon on the ground below him, reproduced as a buzz in his earphones. Just at the edge of the field a signal from a second marker beacon reaches him and is reproduced as a different sounding buzz This gives him warning of the exact moment at which to level off for landing. He thereupon throttles his engine and maneuvers his airplane to follow the landing beam accurately to the point where he is to make contact with the ground.

END.

Tri-Motor

(*Continued from page* 370)

on the ship's belly is proof of nothing but his own exceptional ability as a pilot. The weakness that then existed in the engine mount design of a certain well known tri-motor plane was eliminated shortly after this remarkable accident. Eliminated to the extent that when an occasional motor was lost it did at least leave the landing gear intact. Whether the confidence generally felt towards tri-motor design is warranted or, as I prefer to believe, somewhat exaggerated is of small importance in comparison with other considerations of the design. Certainly it must be obvious that whatever safety this arrangement gains, it is at the expense of economy and efficiency.

It is true that modern tri-motors, or at least planes of this type equipped with modern motors often have quite high cruising speeds and what is generally regarded as good all-round performance. But at what cost! Twelve to thirteen hundred horsepower to propel 15 passengers through the air! In view of the fact that this tremendous power is usually employed to carry a mere fraction of the total accommodation of a passenger plane, the passenger-horsepower ratio becomes ridiculous.

If this is the best we can do after more than 30 years of airplane design, something must be very wrong somewhere and it is not the engine designers who are at fault. In justice it must be said that this fault is not peculiar to tri-motors alone, but as they have the fault and are the subject of these remarks it is proper to mention it.

That more economical performance is possible is proven by ships like the highly efficient Bellanca "Air Bus" which carries 12 passengers at a high cruising speed with a fraction over one-third of the power employed by some of the larger tri-motors.

THERE are other objections to tri-motor design as generally practiced today. The day is coming—soon if the signs may be read aright—when we will be able to look back and laugh at the curious mentality that designers displayed in hanging motors about their creations like ornaments on a Christmas tree. To anyone with a particle of intelligence the proper place for an airplane motor is inside the structure where it can attend to its business unhampered instead of having to waste valuable power in forcing itself through the air.

As things are we commonly see two wing motors suspended from the wings and interfering with the proper function of the wings at these points. A third motor is stuck up in the nose of the ship where it spends its entire working life and an appreciable amount of its effective power in banging a slipstream against the usual slab-sided fuselage.

In brief it seems to me that the whole tri-motor design is a lazy man's excuse for an airplane. It is *so* much easier to stick on a motor here and there than it is to design a really efficient ship that it is not surprising that the issue is dodged and since the public seems definitely to associate three motors with inherent safety it is little wonder that these parodies of a good airplane continue to thunder over our widely flung airways.

END.

U. S. AIR CORPS

Takes in 600 men this year for FREE FLYING TRAINING. Gives them over 200 SOLO HOURS. Special Uniforms. Transportation to the Field. LIVING EXPENSES, and $75 a month while Learning. Real Flying Here. It costs absolutely nothing. Let Us Tell You How to Get In. Information about Uniforms, Rank, Leave, and Actual Life at the New $10,000,000 Field. Hand postman $1 and postage for entire information. Complete. Nothing else to buy.

FLYING INTELLIGENCE BUREAU
401 Judson V. Rives Bldg. Los Angeles, Calif.

Curtiss Goshawk F11C2

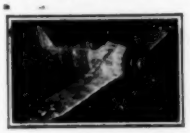
24" Span, Weight 2¼ oz. Flies 700 Feet.
Scale model of latest Curtiss 210 M.P.H. Biplane. Set includes 9 cyl. celluloid motor, motor plate, finished balsa pants, aluminum wheels and pilot's seat, and motor ring, insignias, drawing, dope, glue, all materials. Const. Set.....$2.95

New Curtiss XP934 Pursuit

18" Span, Weight 1 oz. Flies 675 Feet.
An exact model of the Army's new 250 m.p.h. Pursuit, with finished balsa wheelpants, glistening metal exhaust pipes, aluminum wheels, insignias, detail drawing and all materials. Const. Set $1.25

Curtiss Sea Hawk P3A

24" Span, Weight 1⅝ oz. Flies 900 Feet.
A new flying scale model of the tapper-wing Hawk and a sensational value. Set includes 3" celluloid motor, aluminum motor plate, celluloid wheels, insignia, rudder stripes, aluminum pilot's seat, dope, glue, full-size detail drawing, balsa wood, aluminum drag ring. Const. Set.....$2.50



Boeing P26

17" span, weight 1 oz. Flying scale model de luxe equipped with aluminum pilot's seat, turned balsa cowl, celluloid wheels, insignia, detail drawings, etc. Flies 400 feet. Const. Set $1.10

Model Boat and Plane Motors
¼ H.P. Model Gasoline Motors
1/6 H.P. 6 Cyl. Compressed Air Motor
New 1933 Illustrated Catalogue 10c

Miniature Aircraft Corp.
83 Low Terrace New Brighton N. Y.
Dealers write on business letterhead

AERONAUTICAL ENGINEERING
DEGREE IN 2 YEARS

BACHLOR OF SCIENCE DEGREE. Course covers airplane design, propeller design, aerodynamics (including theory of airfoils, stability, performance, etc.), lighter-than-air craft, aircraft engines and all fundamentals. Equipped with a modern wind-tunnel (see illustration) capable of 100 miles per hour air speed; accomodates a 36-inch test model. Non-essentials eliminated. The technical work ordinarily required in 4 years of college given in 2¼ years. Graduates in Mechanical Engineering can complete aeronautical course in 2 terms (24 weeks). Study of entire field of air transportation included. Thorough analysis of every detail of aviation and possible future development made. Flying school facilities available at nearby airports. The aeronautical engineer trained in design, research, manufacture and sales, is the key man in the aviation industry. Development and progress depend on him. He is also in position to reap rich rewards. Students who lack high school training may make up required work, without loss of time. Enter June, September, January, March. Courses also given in Civil, Electrical, Mechanical, Chemical Engineering; Business Administration and Accounting. Living costs and tuition low. Graduates successful. Students from 48 states of the Union and many foreign countries. World famous for technical 2 year courses.

Write for Catalog. 763 *College Ave., Angola, Ind.*

•TRI-STATE COLLEGE•

POPULAR AVIATION
Stands Supreme in its Field

The pigmy and the giant meet in a California field. A Buhl "Bull Pup" stands in front of a new General Aviation transport.

POPULAR AVIATION covers both the large and small airplane. "P. A." embraces the whole field of aeronautics. It appeals alike to the amateur, the professional airman and the general reader.

Among the many departments that *you* cannot afford to miss is the light-plane section, the Barter and Exchange, the Model Department, the Dream Ships and other sections of great interest. Further, and as an additional feature to be continued monthly is the new cover series showing well known planes in action.

Make sure that you obtain the July issue and the succeeding 11 issues by subscribing to P. A. Do it now—the coupon is for your convenience.

POPULAR AVIATION, A-6
608 S. Dearborn St.,
Chicago, Ill.

Please enter my subscription to POPULAR AVIATION for one year. Send me a bill later for $2.50.

Name.....

Address.....

City.....**State**.....

Just fill out this coupon and mail it to us now. We will bill you later—$2.50 for a year's subscription. It is not necessary to pay now.

Akron

(*Continued from page* 354)

business standpoint, we cannot help but understand that the dirigible is a mighty poor investment.

There is not one point in favor of the dirigible as a method of national defense nor as a means of transportation. It is an expensive and dangerous plaything that is only in favor among those who benefit financially or in prestige from its construction or maintenance.

Almost any item connected with the construction or operation of a dirigible must be quoted in terms of millions of dollars, beginning with the first cost and following through to the cost of operation and maintenance.

An investment of $5,000,000 for a slow ineffective dirigible would purchase a fleet of 200 high speed, hard-hitting warplanes, any one of which could easily sink a dirigible alone, and which could be operated in almost any kind of weather.

UNFORTUNATELY, the cost of the dirigible itself is the least of the financial burden. First, immediately after the ship is launched and continuing indefinitely thereafter, are the series of highly expensive readjustments, revisions and alterations that are always coupled with dirigible construction.

Then we have in order, the million dollar dock for housing the ship, the mooring masts, the million dollar (plus) helium plants for supplying the gas, more millions tied up in helium storage and all of the other accessories that go with a dirigible.

During operation there are the salaries of the crew away and above the personnel expenses of an airplane squadron. Then, there is the continuous loss of the expensive helium gas whether the dirigible is in service or resting in her dock.

When the ship does fly, which it seldom does, then we have the tremendous expense of the fuel to consider. And depreciation? Well a hundred percent. depreciation in about two or three years seems to be about the proper figure, which alone amounts to approximately $3,000,000 per year.

Yet, in spite of these sad and expensive experiences, the new super-dirigible, the *U. S. S. Macon* was launched and made its maiden flight. Will the history of this ship be the history of the others? Is it necessary to incur the various expenses and risks of operation that are almost certain, or shall the *Macon* be deliberately destroyed just as the indignant British destroyed the last of their dirigibles?

I believe that it would be more economical, and infinitely safer, to meet the issue face-to-face in the immediate future and rid the government of this white elephant that is always an imminent hazard and an overburdening expense upon the tax-payers.

XUM

If the *Macon* were an effective arm in the national defense, which it is not, then my attitude toward the *U. S. S. Macon* and the *U. S. S. Los Angeles* would be entirely different and I would be a strong advocate of the program of lighter-than-air development. But, when this ship obstructs the progress and development of military aviation by consuming such a large slice of the money appropriated for this purpose, as is the present case, then I am wholly opposed to the dirigible program.

To junk the *Macon* in its mere infancy, together with the *Los Angeles*, would probably bring forth loud cries of denunciation, but it would be by far the cheapest proceeding in the long run. We would at least be spared the tremendous cost of operation and maintenance during the life of the two ships and this life, as we have seen, is short at the best. An economy program, to which the present government officials have committed themselves, most certainly should react against the expense of maintaining useless dirigibles.

Again, the use of a dirigible rapidly and uselessly depletes our limited supply of helium, a gas which has a present industrial value and for which there will be an increased demand in the future. Since helium alone does not insure the safety of a dirigible, it should be put to other purposes. To allow millions of cubic feet of this rare gas to pass into the air through leakage and osmosis seems a useless waste of one of our most valuable natural products.

These expensive helium plants could be utilized for the production of gas for commercial purposes, and therefore would not be a total loss if their service in the production of airship helium were suspended. The docks, of course, could be used for various military purposes so that they would show a certain salvage value.

Salvage of this hull itself consisting of thousands of pounds of very valuable metal would be a further return of some consequence.

The net loss by the destruction of the *Macon* would therefore simply amount to the cost of the ship itself and this would soon be absorbed by a saving equivalent to the cost of operation and maintenance.

END.

Q & A

(*Continued from page 368*)

to use his emergency chute, because of the failure of the service chute, becomes a member of the Caterpillar Club. I fell from 2600 feet to about 200 feet before I got my emergency chute open. Give me some information about this.

Answer:—WE suggest that you write to Major Falk Harmel, Washington, D. C., concerning this rule. He is a Caterpillar Club expert.

* * *

QUESTION:—A. W. S., Morristown, N. J. *I have been interested in the "Brainstorm" article appearing in the January issue. I wish to ask the following questions:* (1) *How does the inverted sesquiplane improve speed?* (2) *Why does a very low wing increase the "cushion effect?"* (3) *Why is an elliptical wing theoretically correct?* (4) *Why not have only one wing, a low or midwing.* (5) *How are the ailerons made to surround the struts?*

Answer:—(1) IT does not necessarily increase the top speed but it increases the speed range between minimum and maximum. (2) The wing compresses the air between its surface and the ground, thus increasing the pressure on the wing and the lift. (3) This is too complicated a question to answer here. Refer to Lanchester's Aerodynamics. (4) The monoplane wing is specifically what I wish to avoid because of its inferior speed range. (5) The ailerons are built so that they swing on the struts, the strut passing through the center of the aileron.

END.

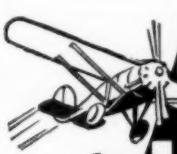
SMOOKLER
Pilot Plane & Port Equipment
Dept. 55, 485 Fifth Ave., N. Y. C.
SUPER SAVINGS SALE

Lot	CHECK YOUR NEEDS	
1.	**GOGGLES**—Luxor No. 7 Reg. $13.75 our price	$10.95
2.	**HELMETS**—Jean cloth, lined, 'Kapok' ear pads (all colors)	1.00
3.	**FLYING SUITS**—"Zipper" Style	4.98
4.	**LOG BOOKS**—Pilot, plane or Engine. Paper cover	.25
5.	**MAPS**—Air Trail's Rand McNally, Reg. 50c, now	.42
6.	**CLOCK**—Pioneer, Luminous, 8-Day, Reg. $17.50, Special	9.95
7.	**COMPASS**—New Jones, Compensating Lighted $7.50, Unlit	6.50
8.	**OIL GAUGES**—100 Lbs., luminous	2.95
9.	**BANK INDICATOR**—spirit type $1.75, Ball type	3.40
10.	**PITCH INDICATOR**—spirit type, Reg. $12.75, now	9.95
11.	**ALTIMETER**—(Zenith) 20,000 ft. Luminous	4.95
12.	**AIR SPEED INDICATOR**—(strut type) 110 m.p.h.	7.45
13.	**COMPASS COURSE PROTRACTOR**—Determines course	.47
14.	**PILOT'S LICENSE CASE**—Leather 6 celluloid windows	2.25
15.	**MECHANIC'S LICENSE CASE**—Leather	1.50
16.	**AVIATION RINGS** (men) Sterling Silver $2.00, (ladies)	1.50
17.	**WRISTLETS**—Sterling $2.25, Green Gold filled	5.00
18.	**WIND CONE**—with bracket and fittings, 8 ft.	10.00
19.	**SHOCK CORD**—3/8" 8c ft., 1/2" 11c ft. 5/8", 17c ft.	.17
20.	**PROPELLERS**—'Heath' (Marshall) wood 25 h.p. $20.00, 30 h.p.	25.00
21.	**LIGHT PLANE & GLIDER WING FABRIC**—40" wide, yd.	.27

No C.O.D. Sent For Less Than $2.00
Send cash and avoid C.O.D. charges. We do not issue catalogs.

Subscribe to
POPULAR AVIATION

• 50 Text
AVIATION
Ground Course
FREE with all drafting courses
AIRCRAFT DRAFTING
AND ALL OTHER BRANCHES
By CORRESPONDENCE
Twenty-third Successful Year
Write for Catalog. Address Dept. P. A. 633
COLUMBIA SCHOOL
1319 F St., N.W. WASHINGTON, D. C.



AVIATION Offers the Better Pay Jobs to LINCOLN-Trained Men

THERE ARE big pay jobs in aviation for properly trained mechanics and pilots. And LINCOLN-trained men are getting them. Here's proof:

" . . . *Since completing my training at the Lincoln School I have been employed as pilot. My salary . . . is . . . $400 a month. . .Lincoln trained pilots are preferred. . .*"—*C. L. Currier.*

The famous training of this World's Best Known School will prepare YOU for a big pay job. Government Approved school, *including blind flying by instrument,* night flying, cross country flying and a complete curriculum fully approved by the U. S. Department of Commerce . . . training that wins quick advancement. And yet LINCOLN'S tuition is most reasonable from the standpoint of excellent training offered.

NOW IS THE TIME to get ready. Exceptional opportunities for LINCOLN trained mechanics and pilots in Central and South America as well as in the U. S. Aviation courses taught in either English or Spanish.

WRITE for complete information. State your age.

LINCOLN AIRPLANE & FLYING SCHOOL
234C Aircraft Bldg. Lincoln, Nebr.

Guynemer

(*Continued from page* 352)

Germans. He was never seen nor heard of again. Not a single trace of his plane was ever found—with Guynemer it evaporated completely. And thus Captain Georges Guynemer, the ace and idol of France, slipped out from a mysterious life to a deeper, mysterious *finis*.

OF THE great ace, Rene Fonck said: "I have been astonished for a long time that Georges was not killed long before this. An excellent shot he was. A great fighting pilot—yes. But he drove himself with a mad and blind determination into an attack. Without a moment's reflection, he would dive straight down a stream of bullets to begin firing himself when he got his enemy at the very end of his gun.

"His wonderful superiority in shooting, his very blindness to danger often made him successful, but you must remember he was brought down more often than any other Ace. Eight times he was shot down and I cannot count the number of shattered struts, the control wires cut by bullets, the fuselage holes, the rudder bar in sections, the holes in his windshield, in his motor and through his flying clothes. His was a method, intrepid, superb—but how foolish!"

Rumors ran rife. Ugly rumors. If Guynemer's plane could not be found the Germans must have forced him down and were holding him prisoner. The Germans remained silent. They refused to disclose any information about Guynemer. Then came rumors he had been tried as a spy and shot. This I never believed. It was never proven. His disappearance became a black unfathomable mystery.

But after the war I was vacationing in the south of France where I met a man . . .

Up in the picturesque Cevennes Mountains I heard of a mystery man who had forgotten his past. His mind was a blank. Some professed he was a shell shocked war veteran. At a village watering place I found him.

The man sat on a stone ledge whittling small wooden models of wartime airplanes. One was a Caudron, another a Nieuport and there were a few Fokkers and Albatrosses. Most of the wooden models were Spads, all identical with the famous plane "Old Charley." The mystery man was tall and very thin, and there was something disturbingly familiar about his pale oval face, thin pointed nose and deep searching eyes.

A scar on his forehead showed where a bullet had injured his brain. The mystery man, between coughs, offered his wooden models for sale. So accurate to detail were they there was no doubting the man knew airplanes if he didn't remember his name or past.

Without realizing what I was doing I exclaimed:

"I know you!"

The man looked up and into his sensitive face there came a great intensity, his eyes flamed, like those of Georges Guynemer when he had said he'd keep on fighting for France.

"You know me, *Monsieur?*" he asked eagerly. "Who—*who am I?*"

This man who suffered from amnesia was so pitiful in his childlike eagerness, I paused. What if I should be wrong? I wasn't positive; it would be unfair for me to give him the name of the man who, for a moment, I was positive he must be.

And so today when I hear people speak of the strange mysterious disappearance and death of Georges Guynemer I recall the slender, coughing, mysterious man in the Cevennes Mountains. If only I were sure!

He haunts my memory.

END.

Photography

(*Continued from page* 356)

soured for a steady stretch we would fare forth in a small town, an enlargment of the city in hand, and solicit print sales at 50 cents each. The novelty of the sky views drew many an eye across the counters. Once the prospect had picked out his store front, located his home and church, the sale was closed.

With the average big aerial photographic concern, a salesman lines up all work in advance at a fancy price. The weakness of the method lies in the frequent inability of a prospective purchaser to appreciate the value of an unseen, unshot air picture. He is likely to shrug off the proposition. But lay a beautiful enlargment, already taken, of his god-child before him and his interest and desire are pricked immediately.

Within a week after working in a new town, word of our reasonable rates would get about and orders would come in. The demand was remarkable. A lawyer offered $50 for a shot of a farm showing its creek at flood stage, the picture to be used in litigation by a disgruntled tenant.

The draw-backs which knocked many ciphers out of our reserve were frequent engine trouble and long periods of cloudy weather. To make the real money possible, picture barnstorming calls for fast turnover. And that, only sunny summer-time can bring.

END.

Mill Importers of
MODEL AIRPLANE
JAPANESE TISSUE
PAPER
MADE IN 32 COLORS
WOOD VENEER
WHITFIELD
PAPER WORKS, INC.
16 Vestry St.,
New York City
Est. 1869

SPECIAL SALE ON STANDARD GRADE
RESISTAL GOGGLES

NAK $5.00—Non-shatterable—Chenille bound..... Now $3.50
RAV $6.00—Non-shatterable. Wide vision—Rubber bound.. Now $4.50
NMR $7.00—Non-Shatterable—Wide vision—Rubber mask.. Now $5.50
DEM—Transport—REG. $11.00 Now $6.50

HELMETS Gabardine White (Free Ear Puffs) . . $1.00
Capeskin Leather—Black—Unlined, $2.50
Capeskin Chamois Lined—Tan . . $3.50

Above items sent prepaid or C.O.D., plus postage. No C.O.D.'s to foreign countries. We do not issue catalogs.
SMOOKLER, Dept. 50, 480 Fifth Ave., New York City, N. Y.

WE CAN'T WAKE HIM UP!

Blame the beds for that—they're so comfortable. Try them yourself. Stay at the Wellington on a "Business Special." (1) Room with bath; (2) American breakfast; (3) Man-sized dinner all for $3.50.

Just say "Business Special" when you register or write for a card on your business stationery.

HOTEL WELLINGTON
55TH ST. AND 7TH AVE.
NEW YORK CITY
"A KNOTT HOTEL"

Build This
NEW BOAT
in 3 days at home with our
COMPLETE KIT $11.75
(all parts cut-to-fit)

The 18-lb. nonsinkable MEAD KI-YAK is the most sensational boat development in years! You can lift it with two fingers; you can carry it on your bicycle; it rides big breakers like a Hawaiian surf-board; it will carry you in 3 inches of water.

FAST LIGHT SEAWORTHY
THE SNAPPIEST THING AFLOAT!

FREE! An 8 ft. double-bladed spruce paddle with the first Kit shipped to each town. Worth $6.00. WE HAVE A REAL MONEY-MAKING PROPOSITION for wide-awake boys. Send dime TODAY for complete information and descriptive circulars.

MEAD GLIDERS
Dept. E-63, 12 S. Market St., Chicago, Ill.

In this FREE BOOK

a World-Famous Flier shows how *YOU* can get into AVIATION

HERE is the book that tells you straight from the shoulder what Aviation offers YOU. You've been wondering how to break into the field—wanting all the facts, all the information. Here it is! A story more exciting, more thrilling, more inspiring than fiction—yet a man-to-man message of FACTS from cover to cover. Walter Hinton—hero of history-making flights—gives you the brass tacks of Aviation today. He shows you exactly *where* your opportunities lie—exactly what to do to make the most of them—exactly *how* to fit yourself for them. Here is a book for men with too much back-bone to stay chained to a small-pay job — too much adventure in their blood for a humdrum grind — too much good, sound business sense in their heads to let this opportunity of a lifetime outgrow them!

The Richest, Fastest Growing Industry the World Has Ever Known

You haven't heard anything about this being a "bad year" for *Aviation!* Cities everywhere are building more airports. Air lines, air service of every kind is growing almost while you watch! There's no doubt about there being BIG PAY plus a *real future* for YOU in Aviation. Your best move is to *get the right training*—QUICK!

Aviation Is Ready, Hinton Is Ready—Now It's Up to YOU

Right at home in spare time, Hinton will teach you all the essential facts about plane construction, rigging, repairs, motors, instruments, theory of flight, navigation, commercial Aviation. Whether you plan to fly, or to cash in on one of the more than forty Big-Pay ground jobs, you *must* have this groundwork to land the job you want at the pay you expect. Clip the coupon and send it TODAY. Hinton will rush your book by return mail.

Aviation Institute of U.S.A., Inc.
WALTER HINTON, President
1115 Connecticut Ave., Washington, D. C.

40
Jobs on the Ground for Each One in the Air

Fliers are in demand—certainly! But for every man in the air, trained men are needed in over 40 highly-paid jobs on the ground. Hinton's training gives you your groundwork to earn real money as one of these:

Engineers, Designers and Draughtsmen, Pilots, Engine and Plane Mechanics, Riggers, Electricians, Welders, Instrument Makers, Wood and Metal Workers, Plane and Motor Inspectors, Airport Operators, Radio Experts, Assemblymen, Aerial Surveyors and Photographers, Aerial Transport Managers, Salesmen.

Walter Hinton

Trail-blazer, pioneer, explorer, author, instructor, AVIATOR. The first man to pilot a plane across the Atlantic—the famous NC-4—and first to fly from North to South America.

The man who was a crack flying instructor for the Navy during the War; who today is training far-sighted men for Aviation. Hinton is ready to back YOU up to the limit. His Book is yours FREE for the coupon below.

Rush Back to Washington!

Walter Hinton, Pres. 836-C
Aviation Institute of U. S. A., Inc.
1115 Conn. Ave., Washington, D. C.

Dear Lieut. Hinton: Send me your FREE Book telling how I can train under you right at home for Aviation.

Name.....

Street.....*Age*.....
(Must be over 18)

City.....*State*.....

Advertise in this Directory. Rates: $2.00 per insertion.

BUYER'S DIRECTORY

One-Inch Advertisements. No more — no less.

AIRPLANES FOR SALE

—CORBEN—
"BABY-ACE"
—AND—
"JUNIOR-ACE"
One and Two Place Sport Planes Offered in Semi-Factory-Built Kits or Complete Fly-Away.
Send Dime for New Illustrated Folder
CORBEN SPORT PLANE CO.
Dept. A Madison Airport Madison, Wis.

ASSEMBLE YOUR OWN
Corben Sport Plane
From Our Famous Semi-Factory Built Kits
—Includes—
Factory Welded Fuselage, Landing Gear, Tail Group, Controls and Wing Struts.
Send Dime for New Illustrated Folder.
CORBEN SPORT PLANE CO.
Dept. A Madison Airport Madison, Wis.

USED AIRPLANES $85 AND UP
Also two factory built Gliders.
Free Flying Instructions. Cars taken in trade. Sensational Bargains. Send 10c for literature.
FEDERAL EQUIPMENT CO.
Dept. 11 Deer Park, Ohio

Heather Henderson, complete	$ 225.00
Whitey Sport, 2 place 45 Anzani	$ 250.00
NB Trainer Genet Engine, 2p80 h.p.	$ 495.00
1927 American Eagle, OX5	$ 250.00
1928 American Eagle, OX5	$ 350.00
Kinner motored Wallace tourplane	$ 550.00
Eaglerock Center section OX5	$ 325.00
Eaglerock long wing OX5	$ 280.00
Wasp Buhl Air Sedan	$1400.00

Time payments, immediate delivery, balance monthly.
Marvin A. Northrop Aeroplane Co. Minneapolis, Minn.

FOR SALE
Identified Heath Parasol with Heath-Henderson motor complete with instruments. Flown six hours. Always hangared, new condition. Just refinished and decorated. Will consider trade for light car or truck. Send dime for photo.
I. C. PETRIE
KREMLIN, MONT.

Retz R8 Biplane
A single place plane. Built of either wood or steel tubing.
BLUE PRINTS $3.00
8—18" x 24" sheets and instructions.
PHOTO 4" x 5".....10c
3-view descriptive Blueprint and specifications 25c
RETZ-AERO SHOP
FARMLAND, IND.

FORD A, POWERED MONOPLANE
Similar to Air-Camper, but with many improvements including welded steel fuselage, split type steel landing gear, special high performance propeller, high compression head and other improvements. Don't confuse this with poorly contructed ship. It is well constructed throughout and very strong yet light. Much safer than wooden fuselage ships. $335 flyaway Macon, Ga. or will crate and load for shipment $15 extra. Photos 10c. Also Gnome 50 h.p. seven cylinder air cooled motor nearly new, less carbureter and magneto, only $25.
G. A. STRIPLING R. F. D. 3, Allen Rd. Macon, Ga.

TUBBS SPEEDWING-SUPER-SPORTSTER MIDGET DUAL BIPLANE
Proven practical and tested basic designs of several NATIONAL AIR RACE WINNERS. Power: "Inverted" 60 H.P. DAYTON AERO Four-In-Line and similar motors.

Span	22'	Speed	135 M.P.H.
Length	16'6"	Cruise	115 M.P.H.
Height	6'6"	Land	45 M.P.H.
Weight	450 lbs.	Power	45-85 H.P.

Complete drawings ONLY $3.00; equals $10.00 sets
TUBBS AIRCRAFT & ENGINE CO.
WHITEWATER, WISCONSIN

INDEX

Airplanes for Sale	400
Airplane Parts	400
Airplane Propellers	400
Books	401
Instruction	401
Gliders	401
Model Airplanes (Ready Built)	401
Model Kits and Plans	401
Model Airplane Supplies	403
Patents	403
Photographs	404
Miscellaneous	404
Classified	404

PENGUIN GROUND TRAINER!
The "ideal" means for training young men and grown-ups alike. Superior to gliders because of "power" control at all times. "It Never Leaves The Ground"; Cheap! Safe! Tested! Practical!

Span	15'3½"	Speed	45 M.P.H.
Length	13'3"	Power	5 H.P.
Weight	150 lbs.	Motor	Optional

Complete dwgs. $1.25; Complete instructions $1.25; Complete kit of materials (less motor & prop) $50.00; Crating $7.50.
(See Nov. 1932 issue P.A., page 315, for illustrations, etc.)
TUBBS Aircraft & Engine Co. Whitewater, Wisconsin

1 place Biplane or Monoplane blueprints	$ 1.00
Builders kits, fuselage welded ribs made, etc., complete	190.00
Complete K. D. kit, all welding done, fittings made, ribs made	225.00
Completed planes, ready to install motor, with instruments	350.00
less instruments	325.00
30 H. P. 2 cylinder motor, including hub	125.00

Photographs, 10c each.
VANCE AIRCRAFT CO.
FRESNO, CALIFORNIA.

AIRPLANE PARTS

SPECIAL SALE

A. N. Specification Safety Belts, 5-in.	$1.50 ea.
Pullies—1½ in. Dia. for ⅛ in. Cable	.15 ea.
Pullies—3½ in. Dia. for ⅛ in. Cable	.20 ea.
1/16" and 1/32" Birch Plywood	.12 Ft.
Steel Tubing 1015 ⅞-1-1⅛ Dia. x 18 Gauge	.12 Ft.
Turnbuckles—Fork and eye	.08 ea.

Spruce ¼" x ¼" strips. 500 Ft. $4.00. ¼" x ½" 500 Ft. $6.00. Balsa Wood—Send 50c for extra large bundle postpaid.
Send stamp for additional bargains.
Jeffer Aircraft Co. 361 Central Ave. Hawthorn, N. J.

OFFER
Enclose three cent stamp for my lists of aeroplanes, parts, and accessories in addition to which you will find a plan for partial payment and delivery of planes to your door that will advance the day of your aerial opportunities.
Marvin A. Northrop Aeroplane Co.
Minneapolis, Minn.

Zenith O-20000 Foot Altimeter
postpaid U. S. and Canada
$2.75
Marvin Northrop Aeroplane Co.
Minneapolis, Minn.

"Brother, Can You Spare a Dime!"
If you can, send it to me and I'll send you my 1933 Low Priced Aviation Material Catalogue.
Karl Ort
688 W. Poplar St., York, Pa.

AIRCRAFT SUPPLIES
SPRUCE—7/32" x 7/32", 1/4" x 1/4", 1/4" x 3/8", 1/4" x 1/2". 1c ft.
PLYWOOD—1/16" or 1/8" 25c sq. ft. CASEIN GLUE, 40c lb.
PROPELLERS—for Henderson, $9.75; for H.D., Model "T", "A", $12.
BLUEPRINTS—of "Aerodrive" propeller attachment for boats, 25c each. 4 dif. types sleds prints, 25c each. All 5 blueprints only $1 postpaid.
OSTERGAARD AIRCRAFT, PARR, INDIANA

Parachute Back Pak 28 ft. An Irwin. Paid $376 for it. It's in excellent condition. Highest cash offer takes it. I will send it C.O.D. Instruction book included. Wire or write.
NEWMAN O. SMITH
Fessenden, R. 2, North Dakota

AIRPLANE PROPELLERS

IMPROVED PROPELLERS
For quick service, order from this ad, cash with order.
4-ft. diameter for Harley and Indian Motors $4.50
4-ft. 6 in. for Heath Henderson metal tipped $8.98
6-ft. for Fords, Lawrence and Anzani metal tipped $9.98
8-ft. for the O. X. 5, laminated Oak, Copper tips $19.95
New Heath Ship, $248.00; 40 H. P. Aeronautical Motors $75.00. New 1933 planes, fly away, $398.00
Photos: Information including leather bound flying manual 25c
HIBBS, Fort Worth, Texas

PROPELLERS
Designed and built for
Racing Planes, Sportplanes, Windtunnels, Hydrogliders, Ice, and Snowsleds.
New low prices on all Special Propellers. Send 3 cent stamp for circular.
LORENZEN PROPELLERS
Dept. P.A. Niles, Mich.

JUNE PROPELLER BARGAINS SPECIAL
4' Dia. for Harley and Indian Twins $ 4.00
4' 6" Dia. for Heath Henderson Fabric tipped 6.50
6' Dia. for Fords, Chevrolet 4, and Anzani, fabric tipped 8.50
6' Dia., hdw., fabric tipped, prop mounted on a HUB to fit crankshaft flange of FORD A & T, CHEVROLET 4 for 10.00
SEND 3c STAMP FOR PROPELLER LIST
RETZ AERO SHOP, FARMLAND, INDIANA

BARGAIN PRICES
On small engines, hubs, propellers and wheels for lightplanes, windwagons, iceboats, scooters and midget cars. Indians, Hedstroms and Harleys with propellers or with sprockets. Single cylinder and twin cylinder air-cooled engines. Ford and Chevrolet converted motors ready to fly. Compass, tachometer, turnbuckles. Midget cars $60, front axles $5, rear axles $3.50. Flying Flivver blueprints $3. Ford conversion blueprints $2. Landing gears, tail surfaces, cheap. Bargain list 10c.
STORMS AVIATION CO. 88 Charlotte St. Asheville, N. C.

For Light Planes
PROPELLERS FOR
Heath B4, Szekley, Continental A40, Fords, and Aeronca motors.
14 x 3 and 18 x 3 aluminum alloy wheels.
KERMIT R. TROYER
75 Mt. Vernon, Grand Rapids, Mich.

Propellers—$3.98 and Up
That give super performance. Manufactured out of select timbers, carefully laminated, scientifically designed by practical engineers. We will bore and attach your hub, carefully crate, and balance at no extra charge. Do not buy until you get our free price lists on Propellers and Ships.
Universal Aircraft Company
Ft. Worth Texas

New Production Propellers
For Sport Planes, Wind Chargers & Souvenir use.
Prices range from $1.98 to $12.50
Sport Planes and Motors
Get our low prices on new production Sport Planes, Kits and Motors.
Send 3 cent stamp for circular
EDDIE J. WEIBLE Hillsboro, N. Dak.

XUM

Advertise in this Directory. Rates: $2.00 per insertion.

BUYER'S DIRECTORY

One-Inch Advertisements. No more — no less.

BOOKS

For Every Flyer
BLIND FLIGHT
IN THEORY AND PRACTICE
By Maj. Wm. C. Ocker & Lt. Carl J. Crane
America's Foremost Instructors
Only complete work thoroughly covering the subject. Permanent cloth bound book over 200 pages, 114 illustrations. Price $3.00. 5 day Money-Back guarantee. Order from Your Dealer or Write
Naylor Printing Co., 918 N. St. Mary's, San Antonio, Texas

Would You Make a GOOD AVIATOR?
"SKYWAYS" by Gen. Wm. M. Mitchell, Former Com. Air Forces, U. S. Army, will tell you! This interesting book describes both technical features of aviation and practical flight. 76 illus. 313 pages; Issued at $3.00—Our bargain cash price, only $1.48, post-paid, or C.O.D. plus postage. Refund in five days if not satisfied.
WOODWORTH'S BOOK HOUSE, Dept. B, 1311 East 57th St., Chicago, Ill.

INSTRUCTION

Work your way into
AVIATION
Send $1.00 for Application Blank, List of Airmail Operators, Air Lines, Factories and Airports, where hundreds are now employed.
Aviation Service Co.
3433 Mohawk St., Lincoln, Nebr.

STUDENT PILOTS and FLYING INSTRUCTORS
Instruction Guide for the Student Airplane Pilot filled with things every pilot must know. A fine Guide for the flying instructor who wishes to standardize his instructions and have his students follow step by step through his primary flying course. The author is a Transport Pilot and Ex-Army Flying Instructor.
Price 50c
Verne W. Bohnke, 1812 20th St., Parkersburg, W. Va.

Free Flying Instruction
WITH PAY AND EXPENSES
U. S. Army accepts over 600 young men each year for training at Randolph Field, Texas. Opportunity open to all. For information how to obtain appointment, send name, address, 20 cents to
Lieut. Carroll
P. O. Box 533 Taunton, Mass.

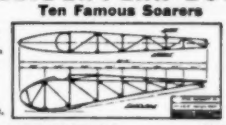
PILOTS LICENSE EXAMINATIONS MADE E-Z
Booklet of 300 typical exam questions with correct answers, includes 1932 changes in Rules and Regulations, Aerodynamics, Engines, Ignition, Navigation and Meteorology. Covers all grades Pilots and Mechanics written exams. Send one dollar today. Booklet of Safety Flying Rules. 115 Don'ts, with reasons on twenty primary flight maneuvers. Price 50c.
E-Z AVIATION SYSTEM
Box 6-P, Rosedale, N. Y.

For complete information on the
Free Flying Training
given by the Army Air Corps, send for our bulletin "FLYING WITH THE ARMY." Flying Cadets are paid a salary while learning. Get full information on how to apply for this training. Price 30c postpaid.
FEDERAL EQUIPMENT CO.
Dept. 11 DEER PARK, OHIO

AVIATION
WOULD-BE-AVIATORS wishing to work on apprenticeship at Airports for Mechanics License write for information on Airlines and Airports where Apprenticeship Connections are established. Enclose stamped envelope.
Mechanics-Universal Aviation Service
Hotel Detroiter Detroit, Mich.

GLIDERS

The GLIDER PLAN-BOOK of Ten Famous Soarers
Complete; Blueprints, Specifications, Flight Performance.



BIG BARGAIN Only 45c. Order Now. HURRY!!!
VIKING AIRCRAFT CO., Hamilton, O.

Soar This Summer
You can easily build your own soarer at low cost. Start NOW and you can fly this summer. We will RUSH complete factory layouts and large scale, detailed plans for a well known UTILITY GLIDER on THREE DAYS FREE APPROVAL. If you keep them, send us $1.85, our bargain price.—Just send 15c postage and tell us to RUSH UTILITY PLANS.
VIKING AIRCRAFT CO.
HAMILTON, OHIO

MODEL AIRPLANES (Ready Built)

DON'T PASS THIS BARGAIN
ALL FLYING MODELS
READY BUILT READY TO FLY
12" SCALE

BELLANCA.....Red	$1.25
FAIRCHILD.....Red and Yellow	$1.25
GYPSY MOTH....Yellow and Black	$1.25

STICK

20" All Balsa R.D.G. Tractor	$ .75

BLACK HAWK
621 Hallace St. Pittsburgh, Pa.

THE "HIGHWAY FLYER"
READY TO FLY—ONLY 75c.
This model has a body built up of 1/64" sheet balsa, a 13" taper-wing and is guaranteed to fly. Floats for this model 25c. We pay postage, packing and insurance charges.
Highway Model Aircraft
1957 W. 4th St., Brooklyn, N. Y.

READY BUILT NON-FLYING SOLID SCALE MODELS

4 in. Boeing P-12C	$ .75
4 in. Curtiss P6E	.75
6 in. Capt. Page Navy Racer	.75
3 in. Fokker D-7	.50
2 in. Boeing XP-936	.35
18 in. Vought Corsair	$5.50

And many others. Dime brings complete list.
Vito Marchino Jr.
15140 Turlington Ave. Harvey, Ill.

READY BUILT REPLICA PLANES
Solid scale model plane built from any construction kit on the market for only twice cost of kit if you send kit, otherwise add cost of kit. For example: a finished plane built from a kit costing 25c for only 50c; otherwise price of finished plane will be 75c. Prompt delivery. Expert craftsmanship, 5 yrs. experience. Prices quoted on flying scale models.
Wm. Neubauer, NORTH OLMSTED, OHIO.

SEA GULL Ready Built Models!!

16" Cabin Commercial, 1000 ft. Flights	$1.25
22" Cabin Commercial, 1500 ft. Flight	2.00
19" "Bullet" Twin Pusher, 3 min. duration	1.95
20" R.O.G. Tractor, 1000 ft. Flight	.75
30" Professor Type Soaring Glider, 2½ min. duration	1.95

All Models Guaranteed to Fly. 25c Packing, Crating and Insurance Charge on all Models
Sea Gull Model Aero Co.
87-10 Rockaway Blvd., Rockaway, L. I., N. Y.

—Finished Scale Models—
These are solid balsa models; until further notice, 10% off on all orders $2 or over.

Boeing P-12—7 in. span	$1.30
Capt. Page Navy Racer—6 in. span	.80
Polish Fighter—6 in. span	.80
Vought Corsair—6 in. span	1.55
Low Wing Boeing—5¼ in. span	.80
Shell Mystery Ship—7 in. span	1.55

ALL SHIPMENTS POSTPAID.
Address VANE BROS. 528 E. 4th St. Mossoco, Ill.

MODEL KITS AND PLANS

Roosevelt's "Air Yacht"
12" Exact Scale Model of President Roosevelt's New "Navy Douglas Dolphin Amphibion." All parts semi-finished and cut to shape. Most complete kit ever designed.
COMPLETE KIT 50c Postpaid, U.S.A.
AERO ACCESSORIES CO.
2196 McDonald Ave. Brooklyn, N. Y.
(Formerly Gravesend Ave.)

Hawk's "Sky Chief"
12" Exact Scale Model of Lt. Commander Hawk's New Speed Ship—Only Official Texaco Sky Chief Kit on the Market. Order this kit and see the difference—all parts are semi-finished and cut to shape.
COMPLETE KIT 50c Postpaid, U.S.A.
Aero Accessories Co.
(Formerly Gravesend Ave.)
2196 McDonald Ave. Brooklyn, N. Y.

I don't believe you can equal these values anywhere

BOEING P12E Extra quality 5/8" solid scale Kit. Full size drawing, printed out balsa silver aluminum finished hardwood wheels, etc., etc. Big value, 35c.
SILVER ARROW 21" flying cabin plane. Excellent performer. Very complete kit. 65c.
SEND $1.00 M. O. FOR BOTH POSTPAID.
W. BURR BENNETT, Box 210, Rossdale, Pa.

HEATH PARASOL COMMANDER 50c EACH
Biggest 50c kit value ever offered or ever will be to the model builder. Balsa parts accurately printed, dope, cement, plans, etc. Nothing else needed.
Add 10c EACH KIT FOR POSTAGE
CONSTRUCT-A-PLANE CO.
285 BUSHWICK AVENUE BROOKLYN N. Y.

20" FLYING BELLANCA SKYROCKET
An unbeatable kit. Printed balsa parts, turned balsa finished nose piece, turned balsa balloon shaped wheels. Dope, cement, instructions, etc. **85c** Add 10c for postage

20" FLYING BOEING P-12C
Complete with machine turned balsa cowl and printed motor balsa ribs and formers. Full size plans and a liberal supply of everything. **$1.10** Add 10c for postage

CONSTRUCT-A-PLANE CO.
285 BUSHWICK AVENUE BROOKLYN, N. Y.

R. O. G. —14" all balsa parts cut to shape. Takes off, flies, banks, loops and glides. **25c EACH**

ALL BALSA REPLICA MODELS

NIEUPORT	6⅝"
HOWARD RACER	6"
BOEING P-12C	7½"
CURTISS HAWK P-6E	7⅝"
MYSTERY "S" RACER	7"
FAIRCHILD "24"	7"

Add 5c EACH KIT FOR POSTAGE
CONSTRUCT-A-PLANE CO.
285 BUSHWICK AVENUE BROOKLYN, N. Y.

Model Airplane Plan and Kits

Sparrow Hawk	22" span Kits	$1.00
Boeing P-12F	20" span Kits	$1.00
Boeing P-26	22" span Kits	$1.00
Monocoupe	20" span Kits	$1.00
Fairchild "24"	22" span Kits	$1.00
Gee Bee	22" span Kits	$1.00

Plans 10c each
Send 3c stamp for Price List, Discount to Dealers
DALLAIRE MODEL AIRCRAFT CO.
10140 Crocuslawn Av. Detroit, Michigan

"ALL PRINT" CONSTRUCTION KITS
New! Bulkheads, ribs, etc. PRINTED on high-grade balsa. All fittings, spun cowlings, tissue, cement, insignias, 3-view blueprints. An 18" construction kit for a flying-scale model that is guaranteed to be COMPLETE.
Curtiss A-8 Attack, Curtiss P-6-E, D. H. Moth, Bernard C-1, Vought O-3-U-2, Howard "Ike," Howard "Pete," Great Lakes Sport, Monocoupe, Travelair Sport. 75c—3 for $2.00. Postage 15c.
E. W. DAVIES AIRCRAFT CO.
1553 Page St. San Francisco, Calif.

(Continued on next page)

Advertise in this Directory. Rates: $2.00 per insertion.

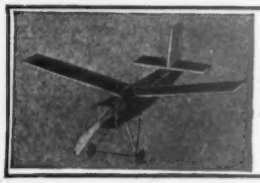
BUYER'S DIRECTORY

One-Inch Advertisements. No more — no less.

MODEL KITS AND PLANS

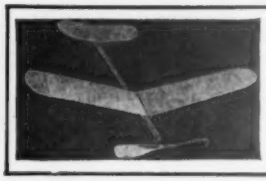
SKY HAWK

12½" Red and White Cabin monoplane. Takes off the ground, climbs like a hawk and easy to build. Complete kit and full size plane..$ .50 p.p.
17¼" Curtiss Robin record smasher.....$1.00 p.p.
Remember all Eagle Kits are easy to build and contain full size plans with detailed instructions.
EAGLE KIT Model Airplane and Supply Co., Dept. 5
Send 3c stamp for catalog. 2906 W. 22nd St., Chicago, Ill.



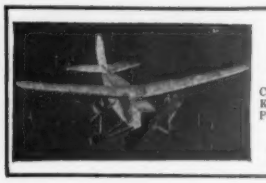
CABIN PLANE JR.

Flying Model Complete Kit 15c Plus 3c postage (Stamps)
G. H. Q.
558 So. Boulevard New York, N. Y.



BABY ENDURANCE PUSHER

Complete Kit sent Postpaid (Stamps) 30C
2 to 4 min. flights
G. H. Q.
558 So. Boulevard New York, N. Y.



FOKKER TRIMOTOR

Flying Model
Complete Kit sent Postpaid (Stamps) 75c
G. H. Q.
558 So. Boulevard New York, N. Y.

FREE

1 Insignia Sheet and 1 bottle of cement, with every order of $1.50 or over.
Solid Scale Models of Curtis Hawk P6E, 7¾" span, Boeing P-12-C, 7½" span, 25c each. Kits complete with colored dopes and all parts stamped.
We carry a complete line of Model Supplies.
SEND 3c STAMP FOR PRICE LIST.
HAVERHILL MODEL AIRPLANE SUPPLY
285 North Broadway HAVERHILL, MASS.

MODEL AIRPLANE PLANS

Full size blue-prints for building authentic ¾ inch flying scale models. Every part clearly shown and detailed full size.
BEECHCRAFT 17R, 26 in. wing span
NORTHROP GAMMA, 36 in. wing span
New FOKKER DXVII PURSUIT, 24 in. wing span
Special price 40c each or 3 for $1.00. Post paid. No stamps or foreign coin.
HUNTINGTON MODEL AIRCRAFT CO.
P.O. Box 8044 Huntington, W. Va.

FULL SIZE PLANS

with instructions of 3 to 8 ft.
UNUSUAL type Flying Models.
Designed by Prof. T. N. de Bobrovsky
Send 3c stamps for complete list
A. L. JONES
51 Greenleaf Ave., W. N. Brighton, N. Y.

Plans for

PADDLE WHEEL flying model . . .
. . . Flying DIRIGIBLE
Flying scale HELICOPTERS . . .
. . . WIND TUNNEL
Send 3c stamp for list.
A. L. Jones
51 Greenleaf Ave. W. N. Brighton, N. Y.

Actual photo of model

CAPT. HAWKS' NORTHROP "GAMMA"

24" Model Kit $2.00 P.P.
Flying Model
Authentic scale model in every detail. Designed by P.W. LINDBERG, model engineer since 1918.
LINDBERGH MODEL AIRCRAFT CO.
3737 N. Sawyer Ave. Chicago, Ill.

Flying Scale Model Kits and Plans

Designed by P. W. LINDBERG, formerly designer for the world's largest Model Airplane Co. Complete Kit including plan P. P. Price
Lockheed Sirius, ½" Scale Model $1.00 Plan 15c
Fokker Tri. DR 1, 1/2" Scale Model $ .50 Plan 10c
Gee Bee NR 2100 3/4" Scale Model $1.50 Plan 25c
Curtiss Hawk P6E, 3/4" Scale Model $2.00 Plan 30c
Hawker Fury, ¾" Scale Model $2.00 Plan 30c
L.S. R.O.G. Pursuit 25c per kit, plus 5c postage. Add 10c for postage when buying plans separately.
LINDBERGH MODEL AIRCRAFT CO., 3737 N. Sawyer Ave., Chicago, Ill.

BELLANCA SKYROCKET

18" Flying Scale Model
A beautiful colored model of this famous plane. No visible fuselage bulkheads. Kit contains ready-cut ribs, cell, drag ring and wheels, our newly developed balsa color, select balsa, colored tissue, complete detailed plan, etc. Easily constructed.
Excellent Flyer.....Complete Kit 85c p.p.
Art Kronfeit's Model Supply
215 Mountain Ave. Arlington, Mass.

HOWARD "IKE"

A beautiful 15½" replica of this famous racer exact in every detail. Weighing only ⅞ oz., it is a consistently good flyer. Kit contains full-size detailed plans, bent wire parts, balsa cut to size, cement, paper, etc. Plans 15c p.p., Kit 85c.
Lennon Model Aero Club
15 Lennon St., Dept. P, Providence, R. I.

FRANK HAWKS' NORTHROP "GAMMA" *the* TEXACO SKY CHIEF

10½" model

2. CURTISS CONDOR Bomber 12" model
PLANS 2c each plus 2c postage
3. { Boeing Bomber 10" / XP-936 Pursuit 3⅝" } Combination Kit
Both to same scale

Any kit, including full-size, detailed drawing, colored dopes, etc., for 25c Postpaid realistic solid models
MAJESTIC MODEL AIRCRAFT CO.
Dept. A, 100 Fifth Ave., New York, N. Y.

Two BIG Models for $1.

21¼" POWER GLIDER! Most popular model in the middle-west. Simple to build and a PERFECT FLYER!

18" SKYLARK, beautiful flying low wing cabin job. Feather weight! Takes off in its own length!

Kit contains only best materials, PLENTY of cement and dope. 2 EFFICIENT propellers, and TWO FULL SIZE BLUEPRINTS!
MIDWEST MODEL AIRPLANE & SUPPLIES
S. E. Corner 50th & Miami Sts. Omaha, Nebr.

N E W M. A. S.

EASY TO BUILD EASY TO FLY
10" Flying Models
1. Boeing P12
2. Boeing ???
3. Fokker D-VII
20c each or 2 for 35c
4. Fairchild 24
5. Midwing Racer
6. Junior Highwing

Plan, paper, reed, glue, rubber, hooks, wheels, bamboo, instructions, stamped and stripped balsa, and prop block.
3c postage per kit. No stamps or checks.
Dealers write for discounts
MODEL AIRPLANE SUPPLY
3638 Oak Park Ave. Berwyn, Ill.

FLYING MODELS

Boeing F4 B4
Curtiss Hawk
Fokker DVII
North-Gamma
Gee Bee
75c 10c Post.
All parts are printed, wire, cement, *E-Z* prop, wheels, etc., etc.
The Model Shop
71-72 69th Street Glendale, L. I.

FREE

Century of Progress Magic Stick with orders of 50c or over
SOLID SCALE MODELS
No. 1 16" Boeing P26 40c No. 3 10" Howard Racer 30c
No. 2 12" Akron Fighter 40c No. 4 12" Northrop Gamma 30c
Plans, balsa parts cut out, wheels and celluloid, 10c postage per kit. No stamps or checks accepted
MODEL AIRPLANE SUPPLY
3638 Oak Park Ave. Berwyn, Ill.

FORD TRI-MOTOR TRANSPORT PLANE

Solid Scale Model—14" Wing Span

$2.00 Complete Kit Postpaid
N. Y. Model Airplane Co.
4010 Church Ave. Dept. P Brooklyn, N. Y.

Sea Gull Model Kits

16" Cabin Commercial—Flights 1000 ft. Flown as either high wing and low wing model. Complete Kit with all material for both models.....75c
19" Single Pusher Duration 2½ min.....50c
19" Bullett Twin Pusher Duration 3 min.....65c
20" All Balsa Soaring Glider.....30c
10c Packing and Postage Charge on all Kits
A Ready Carved Prop with Each Model
Sea Gull Model Aero Co.
87-10 Rockaway Blvd., Rockaway Beach, L. I., N. Y.

FREE PRICE LIST

15" BELLANCA SKYROCKET
PUSS MOTH
MONOCOUPE
WACO MODEL C
AERONCA C-2
FOKKER D VII
35c Each pp.

True scale, printed Balsa, each Kit complete, guaranteed to fly. Best 1/16 x 1/16 x 36 Balsa, 14 for 5c.
SUCCESS MODEL AIRPLANE & SUPPLY CO.
1846 W. 34 Place, Dept. P. A., Chicago, Ill.

LOOKING FOR VALUE?

Approx. 28" wing spread plans of the Curtiss Robin, Hawk, Vought Corsair, Page Racer, Lockheed Vega, Fairchild, etc. Regular 30c seller. Only 10c each. 3 for 25c. They're going fast so order yours now. Swallow "PHANTOM" kit as advertised in last issue of P. A. 50c postpaid. R.O.G. plans printed on JAP tissue 3c each. DEALERS:—This tissue printed plan is a fast seller. Write for large discounts and sample.
Swallow Model Aircraft
3840 N. Newland Ave., Chicago, Ill.

Different Fuselage Models

Kits with all difficult parts including propeller. READY CUT TO ACCURATE SHAPE and READY FINISHED IN SNAPPY COLORS: Red, Yellow, Black. Complete Kits—Fleetster Lowing—Skylark Hiwing $1.00 each Post Paid anywhere in U. S. Hornet D-2—$1.25. All Three for $3.00 postpaid. Semi-finished kits—Fleetster or Skylark 50c. Hornet D-2 65c. All three for $1.50 postpaid. Money Orders only—3c stamp brings catalog.
THAYDOM MODEL AIRCRAFT CO., Atlantic, Penna.

18" SCALE MODELS BEECHCRAFT NORTHROP

Either Kit $1.50
Either Dwg..... .50
Catalogue ..... .25
TUBBS AIRCRAFT & ENGINE CO.
WHITEWATER, WISCONSIN

FREE

A blueprint of the Fairchild "24" (13" span) with the purchase of any of the following plans.
Boeing P-12-F Pursuit—15" span.....$0.20
DeHavilland 4—15¾" span..... .25
Great Lakes Sport Trainer—15" span..... .20
Kari-Keen Coupe—24" span..... .35
DO NOT SEND STAMPS FOR PLANS.
DEALERS—Send 3c postage for prices on complete list.
UNITED PLAN CO.
4807 Capitol Ave., Omaha, Nebraska.

XUM

Advertise in this Directory. Rates: $2.00 per insertion.

BUYER'S DIRECTORY

One-Inch Advertisements. No more — no less.

MODEL AIRPLANE SUPPLIES

MODEL AIRPLANE SUPPLIES

Send your name and address for a sample of Balsa Wood and our prices on model airplane supplies.

Aero Shop, 3050 Hurlbut Ave. Detroit, Mich.

"IT'S A WOW!"
"Materials the Best Ever!"

So say hundreds of boys about our popular "O-3 Supply Kit.' So many agree that they must be right. Get yours now and see for yourself. Price only 25c postpaid. Or send 3c stamp for price list.

AircO Models & Supplies
2193 Alter Road Detroit, Mich.

A NEW POWER

FOR MODEL PLANES OF 3 TO 8 FT. WINGSPAN and Model Racing Boats. Our NEW Featherweight Steam Generator and Radial Steam Engine gives you longer duration, more power and less weight. Send 3c stamp for descriptive circular B9 and prices for Construction Kits or Ready to Run Plants.

R. A. BROOKS
4020 Lake St., Chicago

Cleveland's Dopes and Cements

The wonderful New Enamel Model Dopes (black, white, silver, gold, cream, yellow, orange red, green, olive drab, blue, brown) ● The old transparent dopes (yellow, orange, red, green, blue, black) ● Colorless cement ● Paper cement ● Acetone, for thinning ● 1-oz. bottles, on all 12c, ea.; 2 oz., 20c. ● 15c packing charge, on orders under $1. (Any order subject to and not containing it, will be disregarded).

CLEVELAND MODEL & SUPPLY CO.
1866-PAF West 57th St., Cleveland, Ohio

AA Balsa		Model Supplies	
1/32x2x18"	8 for 10c	Cement, 2 oz.	12c
1/66x2x18"	8 for 10c	Banana Oil, 2 oz.	7c
1/8 x2x18"	6 for 10c	Wire .014, .016, .020, .026, .034, .036, 9 foot	2c
1/2x3/4x6"	8 for 5c		
1x2x18"	10c	Add 10c for Postage	
2x6x18"	35c		

Send 3c Stamp for Price List. Discount to Dealers

Dallaire Model Aircraft Co.
10140 Crocuslawn Ave. Detroit, Michigan

SOMETHING NEW

Model Airplane Controls good for any models from 12" to 36". Complete Kit, all for $0.69. Full size blueprint with instructions.

MONEY ORDER PREFERRED—POSTPAID.

Dickson Model Airoplane Club
923 Price St. DICKSON, PA.

SOMETHING NEW

MODEL LANDING LIGHTS

WILL CAST A BEAM OF LIGHT 6 FT. FULL SIZE BLUE PRINT FOR 18" TO 36" MODELS with instructions for wiring, making switch and sockets. Postpaid 30c (Stamps not accepted.)

Parts can be purchased at Elec. Shops.

DICKSON AERONAUTICAL LAB.
Box 1384 Dickson, Pa.

Carved Balsa Props		Turned Balsa Wheels	
5" One Piece	5c	3/4" (balloon)	4c pr.
6" One Piece	6c	1" (balloon)	5c pr.
7" One Piece	8c	1 3/8" (balloon)	6c pr.
8" One Piece	10c	1 1/4" (with bushing)	6c pr.
9" One Piece	12c	Large Tube Cement 10c	
10" Two Piece	13c	(We stock many hard to get items Contest model supplies a specialty.)	
11" Two Piece	14c		
12" Two Piece	15c		

No order under 25c. Add 15c for postage. Send 3c for complete price list.

ART KRONFELT'S MODEL SUPPLY
215 Mountain Ave. Arlington, Mass.

NEW! DIFFERENT!
"ALUMINUM WHEELS"

For the particular model builder who wishes only the best. These wheels are far superior to any now offered on the market, not only in lightness but strength as well. Hundreds of dollars have been spent in dies and fixtures to manufacture these wheels, 1-1/2" dia. @ 20c per pr.; 1" dia. @ 10c per pr., P. P. No stamps accepted.

LINDBERG MODEL AIRCRAFT CO.
3737 N. Sawyer Ave. Chicago, Ill.

A Real 1/8 h.p. Gasoline Engine

in miniature, for MODEL AIRPLANES and boats. 3/4 in. Bore 3/4 in. Stroke—weight 1 lb.—3200 R.P.M. GET CATALOGUE, REAL BOATS, MOTORS—FITTINGS, ETC.—only 20c (coin). LOUIS P. LOUTREL,
96 McDonough St., Brooklyn, N. Y.

LAQ-A-GLOSS "DOPE"

A quick drying, water proof, MODEL AIRPLANE DOPE. Laquer gloss, yet lighter in weight. Place your order now. Red, green, blue, orange, yellow, black, silver, and colorless. 1 oz. (screw cap) bottle .15c; 2 oz., 25c. No C.O.D., Stamps, or foreign coin. Add 10c postage to order. Send 3c stamp for complete list model supplies.

Robert H. May, Jr.
909 Washington St. Evanston, Illinois

Model Gas Motor

1 CYLINDER 1 1/16" BORE X 1" STROKE 1/4

Horsepower at 4500 R.P.M. Fastest motor on market, water cooled with gear driven water pump. Motor furnished ready to run, suitable for boats only from 3 to 4 ft. Reasonably priced. Send 10c for illustrated catalogue. Model Airplanes, etc.

Miniature Aircraft Corp.
83 Low Terrace, New Brighton, New York

A NEW TRANSMISSION

This new GEARLESS device doubles the endurance and increases the performance of flying models. Two separate strands of rubber run the same propeller. It may be glued to motor stick or fuselage. Directions included.

The whole transmission weighs only 1/40 ounce but will fly models up to 1 1/2 ounces in weight. Retail price, 40c postpaid. Post card brings circular of this and other types of transmissions. Dealers write for discounts.

MODEL AIRPLANE MOTORS
2322 Stuart St., Berkeley, California

QUALITY SUPPLIES!

4" tube colorless cement	5c	Rubber	
3 oz. can clear dope	10c	.045, 1/16 sq., 3/32 flat, 1/8 flat	4 ft. 1c
3 oz. can colored dope	13c	Dope Brushes	
Tissue, wh. or red, 5 for	10c	3 for	12c
Bushings, per dozen,	3c	Wire, all sizes, 10 ft.	3c
Bamboo, 1/16 sq., 1 dz.	3c		

All supplies Guaranteed. No orders under 25c Add 10c postage. No checks or stamps. Send 3c for price list. Dealers send for list.

MODEL AIRPLANE UTILITY CO., (Dept. P-6)
1140—53rd St. Brooklyn, N. Y.

BALSA BARGAINS
SHEETS—16" LENGTHS

1/32 x 2	8 for 10c	1/8 x 2	6 for 10c
1/16 x 2	8 for 10c	1/4 x 2	3 for 10c

Stripe—18" Lengths		Prop. Blocks	
1/16 sq.	34 for 5c	3/8 x 1/2 x 5.10	for 5c
1/16 x 1/8	30 for 5c	1/2 x 3/4 x 6..8	for 5c
1/8 sq.	24 for 5c	3/4 x 1 x 8..3	for 5c
1/8 x 1/4	12 for 5c	3/4 x 1 1/8 x 10..1	for 3c

All supplies guaranteed. No orders under 25c Add 10c postage on all orders. No checks or stamps.

MODEL AIRPLANE UTILITY CO. (Dept.,P-6)
1140—53rd St. Brooklyn, N. Y.

ALL MAJOR WORLDS' INDOOR RECORDS were made with planes using MRL SPECIAL BROWN RUBBER! ! Herbert Owen, World's Baby ROG Record Holder, writes: "Your rubber actually added between 3 and 4 minutes to the time of one of my planes." Joseph Buckly, Phila., writes, "Your rubber has increased the duration of my planes by about 1/3." The first three winners in the Stout Indoor contest used MRL SPECIAL RUBBER. 210 feet 1/8" x 1/30" for 70c, pp. 210 feet 3/32" x 1/30" for 60c, pp. See next ad.

MODEL RESEARCH LABORATORY
131 Winthrop Pl., Englewood, N. J.

THREE NATIONAL CONTEST WINNERS are users of MRL RUBBER! Also Canadian Grand Champion. MRL RUBBER will add 30% to duration, altitude, and distance of your model. 10% more winds, yet 30% more power from this full sized, super-fresh brown rubber. Special assortment A—210 feet 1/8" x 1/30", 10 ft. each of 10 other sizes—1-32, 3-64, 1-16, 5-64, 3-32, 7-64, 9-64, 5-32, 11-64, and 3-16", all 1-30" flat, a TOTAL OF 310 ft. for $1.00, pp.

Write for free sample rubber and catalog.

MODEL RESEARCH LABORATORY
131 Winthrop Pl., Englewood, N. J.

GIVEN! Howard Racer Plan with Every $1.00 Order

BALSA 18" LENGTHS			
1/16x1/16	40, 5c	Wire, 5 ft.	2c
1/16x1/8	30, 5c	Reed, 5 ft.	2c
1/16x1/4	22, 5c	Bearings, 2,	3c
3/32x3/32	28, 5c	Bushings 4,	1c
1/8 x1/8	25, 5c	Washers, 4 doz.	5c
1/8 x1/4	14, 5c	Bamboo 1/16 sq. x 10	1/2 doz. 2c
1/8 x3/8	11, 5c		

Balsa Cutter .30 p.p.
Banana Oil, 2 oz. 6c
Dope, Thinner, 2 oz. 6c
Colored Dope, Cement, 2 oz. 8c
Insignia Sh.. 9c

15c postage. No orders under 40c. 10c extra West of Miss., Can. Send 3c stamp for complete price list.

NEW ENGLAND MODEL AERO SUPPLY
49 Ardmore Ave., Dept. A, Providence, R. I.

GASOLINE MOTORS
For Model Airplanes and Boats

1 & 2 cylinders—7/8" Bore, 3/4" Stroke, 3000 R. P. M. Weight 1 cylinder motor about 7 ounces. Send 10c for full particulars including sectional view drawing of 1 cylinder motor.

POWER MODEL BOAT & AIRPLANE CO.
134 So. Clinton St. Chicago, Ill.

FREE! R. O. G. Plan

With every order we will give absolutely free one plan printed on JAP tissue. It's worth a dime easily. Swallows "Navy Specified" balsa in 18" lengths—1/16" sq. 16 for 5c; 1/8" sq. 11 for 5c; 1/32 x 2" 2 for 5c; 1/16 x 2" each 3c; Jap tissue 4c; Cement—Large tube 8c. Send in your order and get your free plan today.

Swallow Model Aircraft
3840 N. Newland Ave., Chicago, Ill.

BALSA WOOD
Special for Model Builders

100 Pieces, 12 Sizes, 1/16" square to 1/2" x 1". All 18" long, smooth cut, and good quality. Just what the model builder needs. A Real Bargain. Postpaid, 50c

Send 3c in stamps for complete catalogue, kits and supplies, also general information of interest to all model builders.

SWIFT AIR MODEL SUPPLIES
363 Brittain Road, Akron, Ohio

AMAZING DISCOUNTS
To Dealers
Send for Price List

UNIVERSAL MODEL AIRPLANES, INC.,
4018 "P" Church Ave., Brooklyn, N. Y.

FREE

Plans for a flying model of the

HEATH BABY BULLET

If you send for our Free price list. Send postcard with name and address. Kits for above model, 15c postpaid. Flies 100ft. easily. 50 ft., 3/64 rubber, 9c; 3/4" wheels, 2c each.

WOBURN MODEL AIRPLANE SHOP
(Dept. P-6), 17 Belmont St., Woburn, Mass.

PATENTS

UNPATENTED IDEAS CAN BE SOLD

I tell you how and help you make the sale. Free particulars. (Copyrighted)

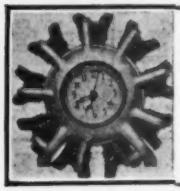
WRITE W. T. GREENE
927 Barrister Bldg. Washington, D. C.

(Continued on next page)

BUYER'S DIRECTORY

MISCELLANEOUS

PATENTS—TRADE-MARKS
Terms reasonable. Personal attention.
Send model or drawing for FREE advice.
Book "HOW TO GET YOUR PATENT" sent on request
L. F. RANDOLPH
REGISTERED PATENT LAWYER
372 Victor Bldg. WASHINGTON, D. C.



For Desk and Home
THE MODERN CLOCK
Finished in gunmetal or black. Front silver- or chromium-plated. Height 6 inches. Unbreakable.
With windmovement.....$3.23
Electric. AC 60 cycle. 100-135 volt.....$3.55
When ordering, state which finish.
BAUDIS ARTCRAFT
348 EAST 92nd ST., NEW YORK, N.Y.

BUILD A FRONT DRIVE!
The details of construction of a Real Baby Front Wheel Drive Auto as this are now in blueprint and available to you. This car powered by a 4-cyl. motor is made of old car parts as Model T, etc. all so cheaply obtained now, and best of all a machine shop is not a necessity for making such a fast one. Send stamp for further details.
Edw. A. Bornstreager, 3458 N. Marshfield Ave., Chicago, Ill.

COLWELL & HERRICK
AERONAUTICAL ENGINEERS
Stress Analysis and Design
LOW RATES
231 Homecroft Rd. Syracuse, N. Y.

Electrical Bargains
Special bargains in Alternating and Direct Current Generators. Also some used. ½ Horse Repulsion Induction Alternating Motors $12.75. Write for quotation on the machine you need.
Electrical Surplus Co.
Dept. 44, 1885 Milwaukee Ave., Chicago

Jig Saw Puzzle Pictures
20 PICTURES BY WORLD FAMOUS ARTISTS $1.00 P.P.
20 Pcs. of 3-Ply Wood to fit same $1.00
Both $2.00 in U. S.
KWIK KUT JIG SAW BLADES, 45c per dozen
PIONEER WOOD CRAFT
4911 Cornelia Ave. Chicago, Ill.

"RED-DEVIL"
JIG SAW TYPE PUZZLE
Some solve it—others cannot. Retail value 10 cents each. Your price, 10 sets for 25 cents or 10 cents for a sample postpaid.
Pioneer Wood Craft
4911 Cornelia Ave. Chicago, Ill.

Save MOTOR REPAIRS use PYROIL
Used by many transport lines as safety factor should oil supply fail in flight. Increases power. 100% Guaranteed. Write for facts and proof.
PYROIL CO.
W. V. Kidder
President
175 LaFollette
LaCrosse, Wisc., U.S.A.
Simply add to Re-gular Oil

PHOTOGRAPHS

WARTIME PLANES
For sale: Hundreds of sharp, clear, actual photographs of pioneer, wartime, and modern airplanes. All 7½ x 9½ inches in size. Send for free list and please mention Popular Aviation.
R. R. MARTIN
1615 N. Western Ave. Hollywood, Calif.

Airplane Photographs
4" x 5" or 8" x 10" photographs of early types and present day airplanes, including those participating in World War. Send 3c stamp for list.
Pilot-Plane Photo Service
Gen. P. O. Box 560-P
NEW YORK

CLASSIFIED

BIG MONEY APPLYING INITIALS ON AUTOMOBILES. Easiest thing today. 50 styles, colors, gold. Looks like hand painted. No experience. Free samples. "RALCO," 1084 Washington, Boston, Mass.

JIG SAW PUZZLES. Jig Saw Puzzles 15c each; 2 for 25c. Clifford Hoffman, 57 Broad, Albany, New York.

QUALITY PRINTING. Exceptionally low prices. Print Anything. National, Syracuse, Indiana.

BUILD YOUR OWN BOAT, using Brooks (Originators of KNOCK-DOWN System) ready-cut materials and save two-thirds regular builders costs, have more successful seaworthy craft. Frames fully assembled. Cruisers, Runabouts, Launches, Outboard Motor, Row and Sail, including Rudders Snipe Class Sailer. Also complete assortment Propellers, Shafting and Accessories. Send 10c for catalog. BROOKS BOAT CO., Inc. Box V-39, Saginaw West Side, Mich.

PATENT Your Invention—"Little Ideas May Have Big Commercial Possibilities." Send for free book. How to Obtain a Patent and Record of Invention Blank." Prompt service. Highest references. Reasonable charges. Deferred payments. Established 1898. Victor J. Evans & Co., 790 Victor Building, Washington, D. C.

MOTION PICTURE Bargains. News reels $2.25, odd reels $1.50. Bargain lists. Hoffman Film Service, 57 Broad, Albany, N. Y.

TO OUR CORRESPONDENTS

Just as a great big favor to the editors of POPULAR AVIATION, we will ask you to kindly send a stamped and self-addressed envelope or postcard with your inquiries.

This insures that the reply will reach you promptly. Where the envelope is not addressed by the sender, we sometimes err in deciphering signatures.

POPULAR AVIATION
608 S. Dearborn St.
Chicago, Ill.

Strafing

(*Continued from page* 350)

in front of the hangars. The pit system of automatic fueling will facilitate the servicing of the many airplanes on a busy day.

As Barksdale Field marks a new step in the development of attack aviation so does the new type of plane which is destined to replace the present standard type of Curtiss "A-3" Falcon. One example of these new types is the A-8, a low-wing monoplane with a 600 h. p. prestone-cooled engine. A water-cooled engine is out of the question as the large radiator offers too big a target. With prestone cooling only a small radiator is needed. Air cooling would, therefore, be ideal, but has the disadvantage of blocking the pilot's forward vision, unless a "V" or "in-line" engine were used.

A small quantity of A-8's are being service-tested by the attack squadrons to determine the usefulness of this model. Other models will no doubt be submitted to the Air Corps for test.

An attack plane must carry from 10 to 20 20-lb. fragmentation bombs, at least four forwarding pointing machine guns and two twin-mounted guns on a flexible carriage operated by the gunner and emergency pilot in the rear cockpit.

A war-strength 28-plane squadron will, in one *fifteen-second* dash at the enemy, drop 140 bombs and fire 28,000 rounds with the forward guns alone. The regiment it attacks, *provided all the men have time to get their machine guns, rifles and other arms in action and have the will to keep using them,* or are uninjured by the air raiders, can fire 12,000 rounds of ammunition, but no bombs, in that brief time.

The airplanes' targets are big, and practically stationary. The groundlings' targets are small, and moving at about 200 miles per hour. Figure it out!

Without a doubt, the attack airplane is one of the most formidable weapons we have today. It has a wonderful offensive power in terms of shot and shell delivered at the enemy, and in turn, its speed and capability of sudden surprise is one of the best possible defenses against return fire. It is difficult for a ground marksman to hit even a slow moving plane, let alone a hedge-hopping speedster.

The present standard type, the Curtiss A-3 Falcon was adopted several years ago only in the hope that something radically different and closer to the ideal would some day make its appearance. This almost obsolete biplane, the A-3, has served its temporary purpose, however. Using it since 1927 the Third Attack Group flyers have developed a modern technique for ground strafing which keeps us in the forefront among nations, not in quantity of equipment, perhaps, but in experience and "know-how."

END.

XUM

100% PROFIT

Building New Boat in 2 Days

5 K. D.
F.O.B. Chicago

PATENT PENDING

$125 RHON RANGER Glider Kit Given

e moment you become an authorized
d Ki-Yak Building Agent, you become
ble to enter the Business Stimulator
est and have the opportunity of win-
a valuable prize. For instance, first
winner receives a complete $125.00
Ranger Glider Kit FREE or a com-
assembled Bat Wing Ice Yacht.
has choice of either.) The sec-
ze winner will get a FREE Bat
ce Yacht Kit worth $50.00. And
third prize winner will be given
installment on the famous Rhon
der Kit! Surely you will want
towards winning one of these
prizes, especially when
earning 100% profit
Ki-Yak Kit work **at**
ne time! We think this
most generous offer we
er seen—think of it—
portunity to spend a
le summer and fall
real cash money with
ibility of getting a
prize **besides!**

not make up your
. . . just send 10c
nvenient coupon for
scinating details.
you delay means
LOSING money
ht just as well be
NEY. Get started
send the coupon.

FIRST PRIZE: Rhon Ranger Glider Kit, (above) or **assembled** Bat Wing Ice Yacht (below)

SECOND PRIZE: Bat Wing Ice Yacht KIT

R" CAP FREE

To Each Mead Ki-Yak Agent

ndsome "Skip-
EE with your
t, whether you
after you
ut' the Ki-
ality Naval

Officer's Cap made of fine white duck with glossy black visor, gold braid, and Anchor emblem. Real leather headband. If you order a Ki-Yak NOW, be sure to write your cap size on Coupon!

PRICES to Mead Ki-Yak Building Agents!

Ki-Yak Kits
the low list
you once
Building
EVEN

MORE THAN 100% PROFIT! Hurry . . . and rush the coupon with ten cents for all the details.

for Details of this Unusual Offer!

Once in a blue moon OPPORTUNITY knocks at your door. This message is your opportunity to **earn at least 100% profit** on each Mead Ki-Yak you assemble and sell . . . and a fair chance to secure a $125.00 Rhone Ranger Glider Kit FREE!

Your entrance into this profitable, fascinating "home-manufacturing" work may well be the turning point of your life. It may mean for you a fast start towards NEW success, prosperity and happiness. Isn't it logical to believe that if you can make 100% profit on EACH DOLLAR you invest in Mead Ki-Yak Kits . . . that Prosperity for you at least is definitely on the way?

Opportunity for Ambitious Men and Boys!

Our popular "Mead Ki-Yak Building Agents" organization is growing by leaps and bounds all over America. We realize there are still many ambitious men and boys who would like to join this group for the purpose of making pleasure profits **and cash profits.** To give you additional incentive to join, we have arranged to award FREE valuable merchandise prizes to the winners of our **Business Stimulation Contest** which is open only to authorized Mead Ki-Yak Building Agents.

Here is a brief word picture (see photo, too) of the sensational new 18 lb. Mead KI-YAK . . . with which you can earn 100% profit. This newly invented craft is non-sinkable, seaworthy and fast. You can lift it with two fingers, carry it on a bicycle or auto and navigate only three inches of water. The Mead KI-YAK is the **snappiest** thing afloat by any standard of comparison . . . and the low cut-to-fit kit price of $11.75 F.O.B. Chicago, represents a real bargain.

If You Can Drive a Nail . . .

then you can easily build a Mead Ki-Yak. You simply cannot go wrong with those **numbered** parts, detailed instructions and clear blueprints. **Our exclusive new construction method** not only saves time but **insures success.** You make 100% profit on each one you assemble and sell . . . and they sell like magic! You will be able to EARN REAL CASH MONEY . . . two dollars come back for each dollar you invest in Ki-Yak Kits. We sincerely feel that this is the opportunity you have eagerly been waiting for . . . either part or full time work . . . earn 100% cash profits.

Investigate Now, Decide later

This message can necessarily give you but a brief outline of the splendid opportunity awaiting you in becoming a Mead Ki-Yak Building Agent. Send ten cents in stamps or coin to cover mailing cost and we will send you by return mail complete details of our 100% Profit-Making Plan, "Sensation" boat circular and facts about the Business Stimulator Contest. This may mean a summer of profit and happiness to you and yours . . . and it does **not** obligate you in any way whatsoever. Remember, OPPORTUNITY usually knocks but once . . . and this is the time! Send the coupon today.

MEAD GLIDERS

12 So. Market St., Dept. E-63, Chicago, Ill.

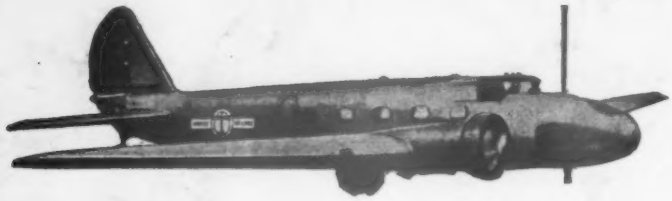
Gentlemen: I am enclosing 10c to cover mailing cost of Ki-Yak circular, and details of your 100% Profit-Making Plan, and the Business Stimulator Contest. This obligates me in no way whatsoever. It is understood that if I purchase a Mead Ki-Yak now or later, I am to receive FREE a "Skipper" Naval Cap.

(Please print clearly)

NAME..... St.....

City..... State.....

"The World's Best Books on Aeronautics"



The Famous West Point Textbook

Simple Aerodynamics and the Airplane

New 4th Revised Edition

by COLONEL C. C. CARTER

United States Military Academy, West Point, N. Y.

EVERYWHERE recognized as the outstanding technical book in the aeronautic field, no other book approaches this in popularity or is so widely used. Although originally designed for the aeronautic instruction of the Army's cadets at West Point, more than 100 of the country's leading technical schools, colleges, and flying schools are also using this book as the foundation textbook in their courses in aeronautical engineering. It is so clearly and simply written that many thousands of individuals not connected with any school are using it to secure by home study the basic technical grounding that is so essential for any man who desires to make substantial progress in this growing field. Pilots find it particularly valuable as a means of obtaining a ready comprehension of factors affecting their planes' performance.

"Simple Aerodynamics and the Airplane" provides a clear and easily understood explanation of the fundamental aerodynamics involved in the design and operation of the airplane. Over 400 questions and problems enable you to check your understanding of each point explained in the text and show you how to make the necessary calculations to estimate the performance of a particular plane under various conditions. The scope of the book ranges from the explanation of the fundamentals of air flow and production of lift to the complete airplane, its stability, maneuverability, and performance. In addition there is much material on construction, navigation, and equipment. Chapters include: Airfoils and Their selection; Parasite Resistance; Propeller; Complete Airplane; Stability; Control Surfaces; Performance; Dynamic Loads; Materials and Construction; Equipment; Navigation.

595 Pages, 395 Illustrations, $4.50

(fill in, tear out, and mail)

Sent Postpaid and Without Advance Payment for Your Examination

The Ronald Press Company,
Dept. M614, 15 East 26th Street, New York.

Send me the books checked below, delivery prepaid. I will either return them and my remittance in payment within five days after the books are received.

☐ Simple Aerodynamics.....$4.50 ☐ Jones, Practical Flying.....$3.00
☐ Aeronautics..... 3.25 ☐ Moors, Engine Mechanics Manual..... 4.50

Check here if you wish complete list of aeronautic publications, free

Name.....

Address.....

City..... State*.....

Recommended by,

Reference.....

(Must be filled in unless you send cash)

*For outside continental U. S. and Canada, send cash plus 25c per book for shipping

"THE RONALD Aeronautic Series, prepared by writers who are authorities on their subjects, is making an important contribution to science. The individual volumes are rapidly becoming classics on their subjects."

MAJOR GENERAL B. D. FOULOIS,
Chief of Air Corps, U. S. Army

Aeronautics

by Hilton F. Lusk, formerly Dean, Boeing School of Aeronautics. 175 illustrations, $3.25.

This new book offers you a complete ground school course in aeronautics, covering all the subjects you need to know to pass the written examinations for a government license as a pilot in any of the grades, including transport pilot, or as a mechanic. So clear you can use it for home study without the aid of an instructor. 224 test questions like those asked in license examinations help you test yourself on each subject covered. Gives all necessary information on Principles of Flight; Airplane, Autogiro Construction and Operation; Propellers; Engine Construction and Operation; Attitude and Engine Instruments; Navigation; Piloting; Dead Reckoning; Avigation Instruments and Equipment; Principles and Applications of Meteorology; etc.

Practical Flying

by Major B. Q. Jones, Air Corps, U. S. Army, formerly Chief, Aviation Training, A. E. F. $3.00.

Your flight training will cost you less and you will be ready for solo hours quicker if you follow the lessons in this famous primary training manual. Both student pilots and veteran transport pilots praise it enthusiastically. It will give you basic flying information you would otherwise have to get by long and costly experience. Taxying, the take-off, the initial climb, emergency landings, straight-away flight, turns, figures-of-eight, glides, landing, cross-country flying, stalls and spins, methods of plane location and testing controls and motor are thoroughly covered.

Aircraft Engines and Mechanical Manual

by C. J. Moors, Chief Inspector, Department of Mechanics, Air Corps Technical School, U. S. Army. 189 illustrations, $4.50.

This new book has already become an indispensable part of the equipment of mechanics in scores of busy airports, because it helps them get better results out of their power plants. Private plane owners use its instructions to reduce the cost of maintenance. All necessary instructions for servicing any type of engine and its accessories are given. For each type the manual illustrates by detailed working diagrams, and photographs—how it is built, how it operates; points of difference and resemblance to other types are carefully pointed out. You are shown just how to find the cause of any trouble. 38 chapters: Elements of Mechanics; Operation, Maintenance and Repair of Specific Engines; Superchargers; Lubricants; Ignition; Electrical Equipmnt; etc.

You Can Order Any of These Books on 5 Days' Approval

You can order any of the books described on this page for 5 days' free examination before purchase. Payment is not due until 5 days after they are delivered; and if not satisfied within that period they may be returned and money will be refunded in every case.

28 Volumes of the Ronald Aeronautic Series Now Available